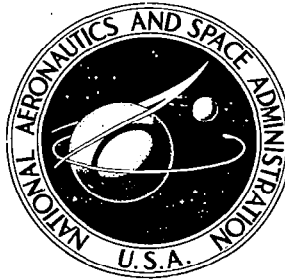


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**A COMPUTER PROGRAM FOR
MÖSSBAUER DATA PROCESSING**

*by Lona M. Howser, Jag J. Singh,
and Robert E. Smith, Jr.*

*Langley Research Center
Hampton, Va. 23365*



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SUMMARY

A computer program to analyze Mössbauer data is presented in detail. The least-squares curve-fitting techniques described in this report apply to single-line spectra, single hyperfine spectra, or when the constituent spectra are separated well enough to let the individual absorption peaks stand alone. The present program has not been adapted for complex spectra resulting from the existence of several local environments in the absorber iron alloy. Sample problems are presented to aid the user in setting up and running the program.

The program is written in FORTRAN IV language for the Control Data 6000 series digital computer with the SCOPE 3.0 operating system and requires approximately 115 000 octal locations of core storage. A typical case with one absorption peak runs in 20 seconds, and a typical problem with six absorption peaks requires 50 seconds.

INTRODUCTION

The Mössbauer effect is one of the recent fundamental scientific discoveries that have found widespread applications in various branches of science. The theory of this phenomenon has been treated quite adequately in a number of recent publications (refs. 1 to 3) and will not be repeated herein. A brief discussion is, however, given in order to point out the basic factors that determine the wide applications of this phenomenon. This discussion will also serve to indicate the desirability – and indeed the necessity – of computer analysis of the Mössbauer spectra.

This report describes a computer program (D3290) developed at the Langley Research Center and provides the user with information necessary to use the program. Curve fitting of the Mössbauer data by using the least-squares analysis with no constraints on the amplitudes, half-widths, and positions of the absorption peaks was the technique used.

The program is written in FORTRAN IV language for the Control Data 6000 series digital computer with the SCOPE 3.0 operating system.

SYMBOLS

A	amplitude of absorption peak
a	coefficient of second-order term in equation of parabola
b	coefficient of first-order term in equation of parabola
c	constant term in equation of parabola
E	energy of incident photon
E_0	resonance energy, that is, energy equal to excitation energy of Mössbauer state above stable (ground) state
ΔE	energy uncertainty
g	gyroscopic factor
H	magnetic field at absorber nucleus
h	Planck's constant of action
$\hbar = \frac{h}{2\pi}$	
I	observed intensity
k	number of parameters
L	Lorentzian profile
M	mass of recoiling system
N	number of absorption peaks
n	number of observations
P	momentum

p	position of the peak on X-axis
x	independent variable, source velocity
y	dependent variable
Γ	width of peak at half maximum amplitude
ϵ	error in y measurement
$\lambda = \frac{\Gamma}{2}$	
μ	magnetic moment of Mössbauer state
ν	frequency
τ	mean lifetime of energy level

Subscripts:

i	observation number
j	absorption peak number
o	nominal conditions

Superscript:

T	transpose of matrix
---	---------------------

PROBLEM DESCRIPTION

Today nuclear resonant scattering of gamma radiation is a technique of major importance in nuclear physics, solid-state physics, theory of relativity, and several other areas. Reviews of this technique, often known as resonance fluorescence or the Mössbauer effect, have been reported by several authors and will not be given herein. In essence, the phenomenon can be described as follows. Various physical systems – nuclei, atoms, and molecules – are characterized by the existence of their discrete energy levels. The energy and momentum of the radiation resulting from the decay of an

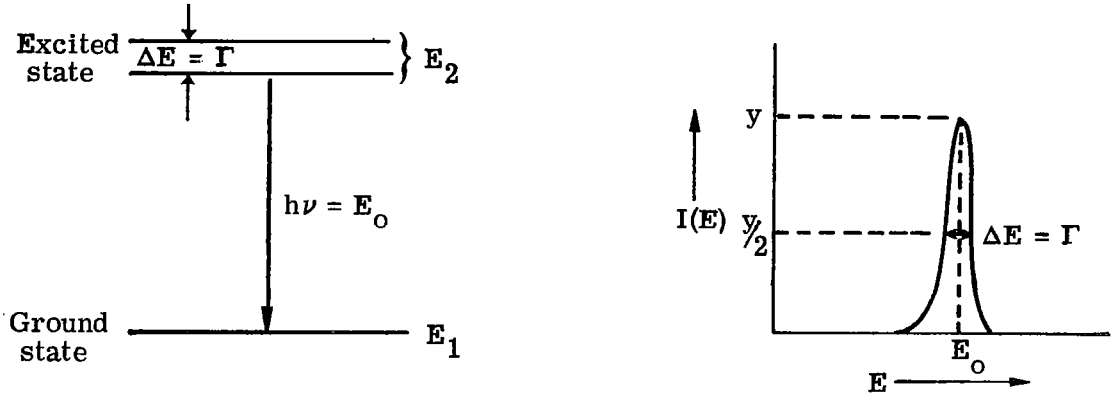


Figure 1.- Energy of an excited state with a mean life τ has a width of Γ . Stable ground state has a sharply defined energy.

excited state to a lower state are not sharply defined. Rather, the emitted radiation spectrum is expected to show a dispersion whose line width Γ is strongly related to the mean life of the excited state, as shown in figure 1. The energy spread ΔE is related to the mean life τ of the energy level by the Heisenberg uncertainty relation

$$\Delta E \gtrsim \frac{\hbar}{\tau} \quad (1)$$

Weisskopf and Wigner (refs. 4 and 5) have treated this problem in detail and have shown that

$$I(E) = \text{Constant} \frac{\Gamma}{2\pi} \frac{1}{(E - E_0)^2 + (\Gamma/2)^2} \quad (2)$$

and that the $I(E)$ curve has a Lorentzian shape. It can be seen from equation (2) that $I(E)$ will be a very sharp function of E if the mean life of the level is very large.

When a system decays from its excited state to a lower state, as a result of the requirement of conservation of linear momentum, a certain amount of energy is used up in providing for its recoil,

$$E_{\text{recoil}} = \frac{(P_{\text{recoil}})^2}{2M} = \frac{E_0^2}{2Mc^2} \quad (3)$$

where M is the mass of the recoiling system and c is the velocity of light. For a decaying nucleus,

$$E_{\text{recoil}}(\text{in eV}) = \frac{(5.37 \times 10^{-4}) E_0^2}{\text{Nuclear mass (in amu)}} \quad (4)$$

where E_0 is measured in keV. Similarly, when the emitted photon is reabsorbed by another nucleus, an equivalent recoil energy must be provided out of the photon energy content. Superimposed on this recoil loss is the energy spread caused by the thermal Doppler broadening of the emitted photons. If, however, the recoil losses at emission and reabsorption can be eliminated – for example, by effectively increasing M – it should be possible to match the emitted photon energy with the resonance energy at the absorber atom by simply giving an appropriate linear velocity to the source atoms. This fact is the basis of the Mössbauer resonance phenomenon. Since the precise emitter or absorber energies are determined by the atomic environments of the respective atoms, any changes in the atomic environments will be reflected in the new Doppler velocity required for the resonance phenomenon.¹ Thus, a Doppler velocity spectrum with an unsplit source is expected to provide useful information on the internal atomic environment of the absorber medium. A manual analysis of the Doppler velocity spectrum is very tedious and subject to large errors. Since the line width is a significant fraction of the bandwidth over which the resonance absorption is observed, it is often necessary that various parameters be estimated to within 0.1 percent, or better, of a line width. This degree of accuracy can be achieved with the help of an electronic computer. Very few programs are currently listed in the literature (ref. 6 and others cited therein), though it can be assumed that almost all laboratories engaged in Mössbauer research have their own computer programs. There are three different approaches to the analysis of a complex Mössbauer spectrum.

1. Computation of Mössbauer spectra from theoretical considerations

Computation of Mössbauer spectra from theoretical considerations is generally useful in sharply defined experimental situations. In structural applications where one is not always aware of the precise environments of the absorber atoms, it is not possible to write the expressions for the pertinent Hamiltonian or include the effects of such factors as absorber thickness and Goldanski effect, which can cause the relative intensities of various hyperfine peaks to differ from the calculated values. (See refs. 6 and 7 for calculational details.)

¹The data are normally obtained in the form of absorption as a function of source-absorber Doppler velocity. It is, however, easy to convert the velocity scale to the energy scale by using $\frac{\Delta E}{E_0} = \frac{v}{c}$ where v is the source-absorber Doppler velocity and c is the velocity of light.

2. Curve fitting of the Mössbauer data by least-squares analysis (with no constraints on the amplitudes, half-widths, and positions of the absorption peaks)

This type of program is suitable when Mössbauer lines are superimposed on a baseline parabola. Two experimental spectra are needed: the spectrum without any absorption and the spectrum with resonance absorption. The spectrum without any absorption can be approximated by a parabola. The spectrum with resonance absorption is actually the absorption peaks superimposed on a baseline parabola. A single absorption peak has a Lorentzian profile:

$$L(x) = \frac{A}{1 + \left(\frac{p - x}{\lambda}\right)^2} \quad (5)$$

where

A peak amplitude

p peak position along X-axis

$$\lambda = \frac{\Gamma}{2}$$

The curve with the absorption peak can be represented by the equation for the parabola plus the Lorentzian profile,

$$y = ax^2 + bx + c + L(x) \quad (6)$$

where a, b, and c are coefficients of the equation of the parabola representing the spectrum without any absorption.

If multiple absorption peaks are present, the absorption data are approximated by a combination of Lorentzian profiles superimposed on a parabola, which may be represented by the following equation:

$$y = (ax^2 + bx + c) + \sum_{j=1}^N \frac{A_j}{1 + \left(\frac{p_j - x}{\lambda_j}\right)^2} \quad (7)$$

where N is the number of absorption peaks. Equation (7) is nonlinear and contains $3N + 3$ parameters to be obtained. The technique of least-squares differential correction

is applied to estimate the parameters. A detailed discussion of the least-squares procedure is found in appendix A.

3. Curve fitting of the Mössbauer data by constrained least-squares analysis

This type of analysis is used when the Mössbauer spectrum is too complex to be treated by procedure 2 alone. The constrained program makes use of the theoretical relationship that exists between the parameters of the Mössbauer lines. Thus, for example, a magnetic iron spectrum could be fitted with five parameters (ref. 8) instead of the 21 parameters required in an unconstrained program.

Most of the available programs have been written for specific geometries. The computer program described in this report should be of general use for the reduction of Mössbauer data based on procedure 2. A description of the program and its application to a typical problem at this laboratory are given herein.

PROGRAM DESCRIPTION

The computer program D3290 was written in FORTRAN IV language for the Control Data 6000 series digital computer with the SCOPE 3.0 operating system. With the present dimensions, the program requires approximately 115 000 octal locations of core storage. A typical case with one absorption peak runs in 20 seconds, and a typical case with six absorption peaks runs in 50 seconds. Tape unit 7 is used for temporary storage during job execution.

By using initial estimates for the parameters as input to the program, a solution is obtained and the results are plotted. The amplitude, the position of the peak on the X-axis, and the width of the peak at half maximum amplitude are the main parameters obtained. Values of derived parameters such as quadrupole splitting, isomer shift, and magnetic hyperfine splitting can be obtained from the main parameters. By making use of the input variables IFLAG and IERR (see input description), the same case can be run with statistical errors on the dependent values. This feature is helpful in obtaining a range of error on the solution parameters. The program allows for a maximum of six absorption peaks and 1025 dependent and independent values. DIMENSION statements can be easily changed to allow for a larger number of absorption peaks.

FORTRAN Variable Description

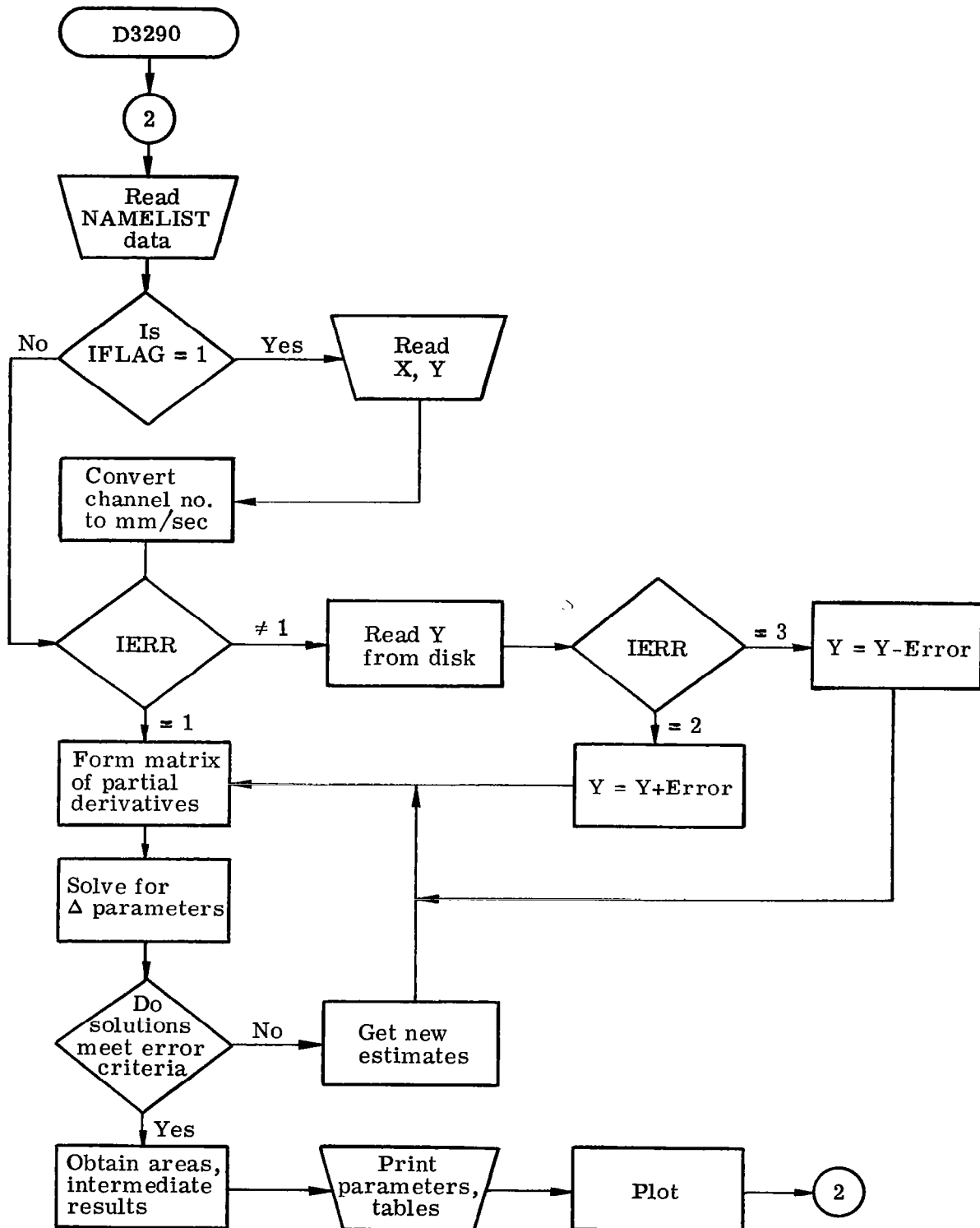
The following list contains a description of the significant FORTRAN variables appearing in the program. The dimensions for each array are beside the variable in the notation A(m,n). The variables which are input will not be presented here, since they are described in the input section.

<u>FORTTRAN variable</u>	<u>Description or symbol</u>
A(6)	A_j
AREA(6)	Area between the curve and the parabola for each peak
ARRAY(1025,21)	Matrix of partial derivatives
B(21,22)	Matrix of coefficients for solution of the simultaneous equations
C(21,1)	Right-hand side of solution of the simultaneous equations
CGAM(6)	λ_j
CO	Initial estimate for parameter c in the equation of the parabola
COMPY(1025)	Computed function values (equivalent to the second column of ARRAY)
ITER	Iteration count
P(6)	p_j
PAR(1025)	Baseline parabola (equivalent to the first column of ARRAY)
R(1025)	Residuals
STD	Standard deviation of residuals

Program D3290, Flow Chart, and Listing

Program D3290 is the main program. It reads and prints the input, sets up the iteration loop, solves the set of simultaneous equations, and obtains the parameter values. It evaluates the other parameters desired for output, prints the output, and calls the plotting routines to plot the results.

The following is the flow chart for the program:



The following is the listing of the program:

```

PROGRAM D3290 (INPUT=201,OUTPUT= 201,TAPE5=INPUT,TAPE6=OUTPUT,
1 SCFILE,TAPE7=SCFILE)
COMMON A(6),AC(6),AREA(6),ARRAY(1025,21),B(21,21),C(21,1),
1 CGAM(6),CGAMC(6),ERROR(21),P(6),PO(6),R(1025),X(1025),Y(1025)
DIMENSION CCMFY(1025),PAR(1025),YYPAR(2050)
DIMENSION PRM(3),XM(2)
EQUIVALENCE (PRM(1),SAO),(PRM(2),BO),(PRM(3),CO)
EQUIVALENCE (CCMPY(1),ARRAY(1,1)) ,(PAR(1),ARRAY(1,2))
EQUIVALENCE (YYPAR(1),ARRAY(1,3))
DIMENSION IFIVCT (21),INDEX(21,2)
EQUIVALENCE (R(1),IPIVOT(1)),(R(22),INDEX(1,1))
DIMENSION V(21,21)
EQUIVALENCE (V(1,1),ARRAY(1,4))
NAMLIST /NAM1/ AO,BO,CGAMO,ERROR,IERR,IFLAG,IPRINT,NP,PO,SAO
1 ,VELB
DATA XM,YM/20H X VALUES (MM/SEC),9H Y VALUES/
NRC=21
CALL CALCCMF
CALL LEROY
CON=1
2 READ (5,NAM1)
IF (EOF,5) 4,6
4 CALL CALPLT (C,0,999)
STOP
6 CONTINUE
IF (IFLAG.NE.1) GO TO 27
READ (5,9) IC,NO
9 FORMAT (5X,I5,I10)
IF (NO) 10,19,19
10 NO=-NO
CON=-1
19 READ (5,11) (X(I),Y(I),I=1,NO)
11 FORMAT (8(F4.0,F6.0))
C SCAN ARRAY AND INTERPOLATE FOR BAD POINTS
J=1
DO 18 I=2,NC
IF (Y(I).EQ.0.) GO TO 16
IF (J.EQ.1) GO TO 18
FAC= (Y(I)-Y(K))/J
J=J-1
DO 13 N=1,J
13 Y(K+N)=Y(K-1+N)+ FAC
J=1
GO TO 18
16 IF (J.EQ.1) K=I-1
J=J+1
18 CONTINUE
REWIND 7
WRITE (7) (Y(I),I=1,NO)
CO=Y(1)
ANO=NO-1
X1=X(1)
SUM = VELB *2.
DO 21 I=1,NC
X(I)= (VELB-SUM* (X(I)-X1)/ANO) *CON
21 CONTINUE

```

```

27 ITER=0
WRITE (6,27CC) ID,IERR
2700 FORMAT (*1CASE NO.*I5,5X*IERR=*I3)
IF (IERR.EQ.1) GO TO 32
REWIND 7
READ (7) (Y(I),I=1,NO)
GO TO (32,28,29),IERR
28 DO 2810 I=1,NC
Y(I)=Y(I)+ SQRT(Y(I))
2810 CONTINUE
GO TO 32
29 DO 2910 I=1,NC
Y(I)=Y(I)- SQRT(Y(I))
2910 CONTINUE
32 DO 40 I=1,NC
XSQ=X(I)**2
ARRAY(I,1)=XSQ
ARRAY(I,2)= X(I)
ARRAY(I,3)=1.
FX= SAG*XSQ + BO*X(I)+ CO
R(I)=(Y(I)- FX)
40 CONTINUE
80 NP3=3*NP+3
N1=NP3+1
C INITIALIZE PLCT ROUTINE AND SET ORIGIN
MM=4
DO 110 M=1,NP
SAVE= CGAMC(M)**2
DO 100 I=1,NC
SAVE1= PO(M)- X(I)
SAVE2= SAVE +SAVE1**2
ARRAY(I,MM)= SAVE/SAVE2
ARRAY(I,MM+1)=-2.0*AO(M)*SAVE*SAVE1/SAVE2**2
ARRAY(I,MM+2)= 2.0*AO(M)*CGAMO(M)*SAVE1**2/SAVE2**2
FX= AO(M) *ARRAY(I,MM)
R(I)=R(I)-FX
100 CONTINUE
MM=MM+3
110 CONTINUE
C ARRAY TRANSPCSE * ARRAY
DO 120 K=1,NP3
DO 118 M=1,NP3
B(K,M)=0.0
DO 115 I=1,NO
B(K,M)=ARRAY(I,K)*ARRAY(I,M) + B(K,M)
115 CONTINUE
118 CONTINUE
120 CONTINUE
C ARRAY TRANSPCSE * R
DO 129 K=1,NP3
C(K)=0.0
DO 125 M=1,NC
125 C(K)=ARRAY(M,K)*R(M) + C(K)
129 CONTINUE
CALL MATINV (B,NP3,C,1,DET,PIVOT, INDEX,21,ISCALE)
ITER=ITER+1
DO 142 I=1,3
TEST1= ABS(C(I)/PRM(I))
IF (TEST1.GT.ERROR(I)) GO TO 800

```

```

142 CONTINUE
MM=4
DO 145 M=1,NP
TEST1= ABS(C(MM)/AO(M))
IF (TEST1.GT.ERROR(MM)) GO TO 800
TEST1= ABS(C(MM+1)/PO(M))
IF (TEST1.GT.ERROR(MM+1)) GO TO 800
TEST1= ABS(C(MM+2)/CGAMO(M))
IF (TEST1.GT.ERROR(MM+2)) GO TO 800
145 CONTINUE
165 MM=4
SAO=SAO+ C(1)
BO=BO+C(2)
CO=CO + C(3)
DO 168 M=1,NP
A(M)= C(MM)+ AO(M)
P(M)= C(MM+1) + PO(M)
CGAM(M)= C(MM+2)+ CGAMO(M)
MM= MM+3
168 CONTINUE
DO 170 I=1,N0
R(I)=Y(I)
170 COMFY(I)=C.O
DO 174 M=1,NP
DO 172 I=1,NC
COMFY(I)=A(M)*CGAM(M)**2/(CGAM(M)**2+(P(M)-X(I))**2)+ COMFY(I)
172 CONTINUE
174 CONTINUE
DO 176 I=1,NC
PAR(I)= SAC*X(I)**2 + BO*X(I) +CO
COMFY(I)= COMFY(I) + PAR(I)
176 R(I)=R(I)-COMFY(I)
STD=0.0
DO 178 I=1,NC
178 STD=R(I)**2+ STD
ANN=NO-NP3
STD=STD/ANN
DO 181 I=1,NP3
DO 180 J=1,NP3
V(I,J)=B(I,J)*STD
180 CONTINUE
181 CONTINUE
DO 183 I=1,NP3
183 V(I,1)=SQRT(V(I,1))
STD=SQRT(STD)
P1=VELB**3/3.
P2=VELB**2/2.
AR1=SAO*P1 + BO*P2 + CO*VELB
AR2= -SAO*P1 + BO*P2 -CO *VELB
AREA1= AR1 - AR2
AREA2=0.
WRITE (6,185) SAO,V(1,1),BO,V(2,1),CO,V(3,1),ITER
185 FORMAT (48F10.4,COEFFICIENTS OF PARABOLA Y= SA*X**2 + B*X + C/ *
1 SA=*E15.8, *(T*E9.3,*)*,5X*B=*E15.8, *(T*E9.3,*)*,5X,*C=*E15.8,
2 *(T*E9.3,*)*/
3 1F+,19X,1H-,33X,1H-,33X,1H-/*NO. OF ITERATIONS=*I6)

```



```

      DO 200 M=1,NP
C
C  EVALUATE INTEGRALS TO GET AREAS FOR PHI2
C
      C1= A(M)*CGAM(M)**2
      AC=CGAM(M)**2 +P(M)**2
      BC = -2.0* F(M)
      CC = 1.0
      Q = 4.0 *AC*CC -BC**2
      IF (Q ) 186,940,187
186  FAC = 12.*CC + BC
      FAC1= SQRT (- Q)
      FAC2= (FAC - FAC1) /(FAC + FAC1)
      FAC =ALOG (FAC2)
      AR1 = FAC / FAC1
      FAC = -12. *CC + BC
      FAC2= (FAC -FAC1)/ (FAC + FAC1)
      FAC = ALOG (FAC2)
      AR2 = FAC/ FAC1
      AREA(M)=(AR1- AR2) *C1
      AREA2= AREA(M) + AREA2
      GO TO 189
187  FAC1= SQRT (Q)
      FAC =(12.C*CC + BC )
      FAC2=ATAN2(FAC,FAC1)
      AR1 = 2.0 * FAC2 / FAC1
      FAC =(-12.C*CC +BC )
      FAC2=ATAN2(FAC,FAC1)
      AR2 = 2.0* FAC2/ FAC1
      AREA(M)=(AR1- AR2) *C1
      AREA2= AREA(M) + AREA2
189  CONTINUE
      PHI2=ABS(AREA2/AREA1)
      AIS=P(M)
      GAM=2.*CGAM(M)
      WRITE (6,19C) M
190  FORMAT (*OF PARAMETERS FOR PEAK*I3)
      WRITE (6,19E) AIS,GAM
195  FORMAT (*OIS=*E15.8,5X*GAM=*E15.8)
      MS=3*M
      WRITE (6,205) A(M),V(MS+1),P(M),V(MS+2),CGAM(M),V(MS+3),AREA(M)
200  WRITE (6,204)
204  FORMAT (1H+,1EX,1H-,33X,1H-,36X,1H-)
205  FORMAT (*OA=*E15.8, *(T*E9.3,*)*,5X*P=*E15.8, *(T*E9.3,*)*5X*CGAM=
      2*E15.8, *(T*E9.3,*)*,5X*AREA=*E15.8)
      IF (NP.NE.1) GC TO 207
C  EVALUATE THESE PARAMETERS IF ONLY ONE PEAK
      YMAX=SAQ*P(M)**2 + B0*P(M) + C0
      PHI1=A(M)/YMAX
      PDP=PHI1/PHI2
      WRITE (6,206) PHI1,PHI2,PDP
206  FORMAT (*OPHI1=*E15.8,5X*PHI2=*E15.8,5X*PHI1/PHI2=*E15.8)
      GO TO 210
C  EVALUATE THESE PARAMETERS IF MORE THAN ONE PEAK
207  AIS= .25 *(F(1) + P(2) + P(5) + P(6))
      QS=.25*(P(2)+ P(5)- P(1)-P(6))
      GO1= P(5) - P(3)
      GO2 = P(4) - P(2)
      G1 = P(3) - P(2)

```

```

      AM1 = (ABS(A(6)) + ABS(A(1)))/(ABS(A(5)) + ABS(A(2)))
      AM2 = (ABS(AREA(1)) + ABS(AREA(6)))/(ABS(AREA(2)) + ABS(AREA(5)))
      WRITE (6,205)
209  FORMAT(*OTHESE PARAMETERS HAVE BEEN OBTAINED FOR MULTIPLE PEAKS*)
      WRITE (6,208) AIS, QS, GO1, GO2, G1, AM1, AM2, PHI2
208  FORMAT (*0 IS=*E15.7,5X* QS=*E15.7,5X*GO1=*E15.7,5X*GO2=*E15.7,5X
1 * G1=*E15.7/* M1=*E15.7,5X* M2=*E15.7,5X*PHI=*E15.7)
210  IF (IPRINT. EQ.0) GO TO 380
      WRITE (6,230)
230  FORMAT (*CHANNEL NO.*3X*X MM/SEC*14X*Y*14X*COMPUTED Y*10X
1 *RESIDUALS*10X*PARABOLA*)
      DO 315 I=1,NC
      WRITE (6,312) I,X(I),Y(I),COMPY(I),R(I) ,PAR(I)
312  FORMAT (I6,5E20.8)
315  CONTINUE
      WRITE (6,370) STD
370  FORMAT (*CSTC=*E15.6)
380  K=1
      IF (IERR.NE.1) GO TO 2
C  COMPUTE MINIMUMS AND MAXIMUMS
      XPG=12.
      CALL ASCALE (X,XPG,NO,K,10.)
      YPG=10.
      NUM=2*NO
      DO 400 I=1,NC
400  YYPAR(I)=Y(I)
      N1=NO+1
      DO 410 I= N1,NUM
410  YYPAR(I)=PAR(I-NO)
      CALL ASCALE (YYPAR,YPG,NUM,K,10.)
      NP1=NO+1
      NP2=NO+2
      Y(NP1)=YYPAR(NUM+1)
      Y(NP2)=YYPAR(NUM+2)
      PAR(NP1)=Y(NP1)
      PAR(NP2)=Y(NP2)
      COMPY(NP1)=Y(NP1)
      COMPY(NP2)=Y(NP2)
C  DRAW X AXIS
      XDV=10.
      XTIC=1.
      CALL AXES (C.,0.,0.,XPG,X(NP1),X(NP2),XTIC,XDV,XM,.15,-20)
C  DRAW Y AXIS
      YDV=10.
      YTIC=1.
      CALL AXES (C.,C.,90.,YPG,COMPY(NP1),COMPY(NP2),YTIC,YDV,YM,.15,9)
C
C  PLOT CURVE
C
      CALL PLPT (X,Y,NO)
      IF (ITER.GE.30) GO TO 600
340  CALL LINPLT (X,COMPY,NO,K,0,0,0,0)
      CALL LINPLT (X,PAR,NO,K,0,0,0,0)
C  ESTABLISH A NEW REFERENCE POINT FOR THE NEXT GRAPH
600  CALL CALPLT (14.,0.,-3)
      GO TO 2

```

```

800 MM=4
   IF (ITER.GE.30) GO TO 1000
   DO 900 M=1,NP
   AO(M)= C(MM)+ AO(M)
   PO(M)=C(MM+1) + PO(M)
   CGAMO(M)=C(MM+2) + CGAMO(M)
895 MM=MM+3
900 CONTINUE
920 SAO=SAO+ C(1)
   BO= BO+ C(2)
   CO =CO+ C(3)
   GO TO 32
940 WRITE (6,550) A,P,CGAM
950 FORMAT (*0 WHEN EVALUATING THE INTEGRALS Q EQUALS 0., THIS CANNOT
   1 BE, A,P,CGAM ARRAYS FOLLOW */(7E18.6))
   GO TO 2
1000 DO 1020 I=1,NC
1020 PAR(I)=Y(I)
   GO TO 380
   END

```

Subroutine MATINV

Subroutine MATINV is described in detail in appendix B. Program D3290 uses this subroutine to invert and solve the matrix of normal equations.

Plotting Routines

The plotting routines used are from the CalComp software package. Output for plotting is routed to a tape during job execution and after job completion is plotted on a CalComp digital incremental plotter. The arrays X, Y, COMPY, and PAR are used for plotting.

PROGRAM USAGE

Input

The input used for the program is a combination of FORTRAN NAMELIST and FORTRAN READ statements. The NAMELIST data are the first data and are followed by the data cards to be read by READ statements. A deck setup is shown in figure 2, and an example of input data is shown in appendix C.

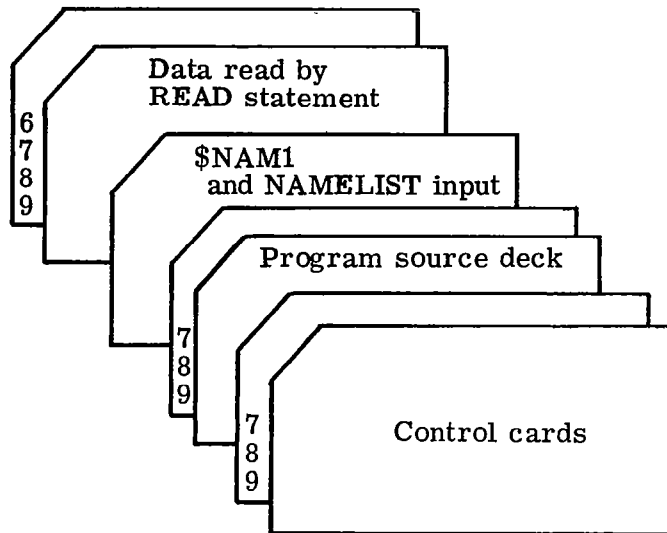


Figure 2.- Deck setup.

NAMELIST data.- The following list contains the input variables loaded by FORTRAN IV NAMELIST with the name NAM1. The size of an array is limited to the dimensions stated in parentheses beside the variable.

<u>FORTRAN variable</u>	<u>Description</u>
AO(6)	Initial estimate for the amplitude A_j . There will be one for each peak where AO(1) is the estimate for the peak with the lowest channel number. The remaining are listed in ascending order.
BO	Initial estimate for the coefficient b of the linear term in the parabola
CGAMO(6)	Initial estimate for the half-width λ_j . There will be one for each peak, where CGAMO(1) is the estimate for the peak with the lowest channel number. The remaining are listed in ascending order.
ERROR(21)	Relative error for each parameter used to test for convergence
ERROR(1)	relative error for a
ERROR(2)	relative error for b
ERROR(3)	relative error for c
ERROR(4)	relative error for A_1
ERROR(5)	relative error for P_1
ERROR(6)	relative error for Γ_1

FORTRAN variableDescription

	ERROR(7)	relative error for A_2
	ERROR(8)	relative error for P_2
	ERROR(9)	relative error for Γ_2
	.	
	.	
IERR	Integer used to indicate which error calculation is to be made	
	IERR	$\left\{ \begin{array}{l} = 1 \quad \text{data are to be used with no error added} \\ = 2 \quad \text{data are to be used with an error } +\sqrt{y_i} \text{ added} \\ \quad \text{to every } y_i \\ = 3 \quad \text{data are to be used with an error } -\sqrt{y_i} \text{ added} \\ \quad \text{to every } y_i \end{array} \right.$
IFLAG		Integer used to indicate if new independent and dependent variables will be read in
		$\left\{ \begin{array}{l} = 1 \quad \text{x and y values will be read in after the} \\ \quad \text{NAMELIST data} \\ \neq 1 \quad \text{no new x and y values will be read in} \end{array} \right.$
IPRINT	Integer to allow for additional printout	
	IPRINT	$\left\{ \begin{array}{l} = 0 \quad \text{regular printout} \\ \neq 0 \quad \text{a table of each x value and its y value,} \\ \quad \text{computed y value, residual, and value of} \\ \quad \text{the parabola at that point will be printed} \end{array} \right.$
NP		Number of peaks
PO(6)	Initial estimate for the peak position p_j . There will be one for each peak where PO(1) is the estimate for the peak with the lowest channel number. The remaining are listed in ascending order.	
SAO	Initial estimate for the coefficient a of the second-order term in the equation of the parabola	
VELB	Maximum value of source-absorber Doppler velocity	

READ statement data.— The following variables are input by using a FORTRAN READ statement. The format used is shown in parentheses beside the variable.

<u>Card</u>		<u>Description</u>	<u>FORTTRAN variable</u>	<u>Format</u>
First card	ID	Case identification number	ID,NO	(5x,I5,I10)
	NO	Number of x and y values to be read If NO is positive, the first channel number will be converted to +VELB mm/sec. If NO is negative, the first channel number will be converted to -VELB mm/sec.		
Remaining cards	X	Independent variable, read in as a channel number and converted to mm/sec by the program on a velocity axis of -VELB to +VELB mm/sec	X,Y	4(F4.0,F6.0)
	Y	Dependent variable		

Output

An example of the output is shown in appendix C. Headings and interpretations are as follows:

<u>Heading</u>	<u>Description</u>
CASE NO.	Identification number
IERR	Identifies if any error was imposed on data (see input variable IERR)
SA	Coefficient of second-order term in equation of the parabola
B	Coefficient of first-order term in equation of the parabola
C	Constant term in equation of the parabola
NO. OF ITERATIONS	Number of iterations necessary for convergence to desired accuracy
IS	Isomer shift of peak
GAM	Γ
A	Amplitude of peak
P	Position of the peak on the velocity axis
CGAM	λ
AREA	Area between curve and parabola for peak

A number appearing in parentheses after a parameter is the estimate of the error bounds for that parameter.

For a single peak the following are printed:

<u>Heading</u>	<u>Description</u>
PHI1	Ratio of amplitude to y value of parabola at peak
PHI2	Ratio of area between curve and parabola to area under parabola
PHI1/PHI2	Ratio of PHI1 to PHI2

For multiple peaks the following derived parameters are printed:

<u>Heading</u>	<u>Description</u>
IS	Isomer shift of the peak, $\frac{1}{4}(p_1 + p_2 + p_{N-1} + p_N)$
QS	Quadrupole splitting in a complex spectrum, $-\frac{1}{4}(p_1 - p_2 + p_N - p_{N-1})$
GO1	Magnetic hyperfine splitting between lines 3 and 5 in Fe ⁵⁷ spectrum, $p_{N-1} - p_3$
GO2	Magnetic hyperfine splitting between lines 2 and 4 in Fe ⁵⁷ spectrum, $p_{N-2} - p_2$
G1	Magnetic hyperfine splitting between lines 4 and 5 in Fe ⁵⁷ spectrum, $p_{N-3} - p_2$
M1	Ratio of intensity of line 1 and line 2; also called I_1/I_2 in Fe ⁵⁷ spectrum, $\frac{ A_1 + A_N }{ A_2 + A_{N-1} }$
M2	$\frac{\text{Area of peak 1} + \text{Area of peak N}}{\text{Area of peak 2} + \text{Area of peak N - 1}}$
PHI	$\frac{\sum (\text{Area of peaks})}{\text{Area under parabola}}$

In each case the area of a peak refers to the area between the curve and the parabola.

The following will be printed in six columns if IPRINT \neq 0:

<u>Heading</u>	<u>Description</u>
CHANNEL NO.	Channel number
X MM/SEC	x
Y	y
COMPUTED Y	Computed function
RESIDUALS	Residuals
PARABOLA	Value of the parabola
STD	Standard deviation of residuals

Diagnostics

The program will stop execution if either of the following two errors occurs:

1. If the number of iterations for convergence exceeds 30, the baseline parabola will be plotted, and the program will go to the next case.
2. If a division by zero occurs in evaluating the areas, a message is printed, the values of the parameters are printed, and the program will go to the next case.

If either of those conditions occurs, new estimates for the parameters can be tried.

Applications

The program described herein has been applied to investigate changes in two types of stainless steels subjected to longitudinal stress in the range of 0 to 10 kbar. The stress-induced extensions in the steel specimen lead to changes in the electronic environment of the absorber iron atoms. These changes are reflected in the position and the shape of the Mössbauer resonance lines. By systematic measurements of the various Mössbauer parameters in the absorption spectra under different stresses, it was hoped to study the dependence of the observed Mössbauer parameters on the applied stress. Such stress-parameter relationships, if proved to be strong, are expected to be useful in remote stress measurements in steel structures.

A schematic diagram of this experimental setup used in measuring Mössbauer spectra is shown in figure 3. A 2-millicurie Co⁵⁷ source in a platinum matrix provided the 14.4-keV radiation, whose energy was Doppler shifted by changing its velocity. Representative Mössbauer spectra in carbon-rich steel (AISI C1095) and noncorrosive, high-strength, nonmagnetic steel (AISI type 316) under different stresses are shown in figures 4 and 5, respectively. All these spectra were analyzed by using the present

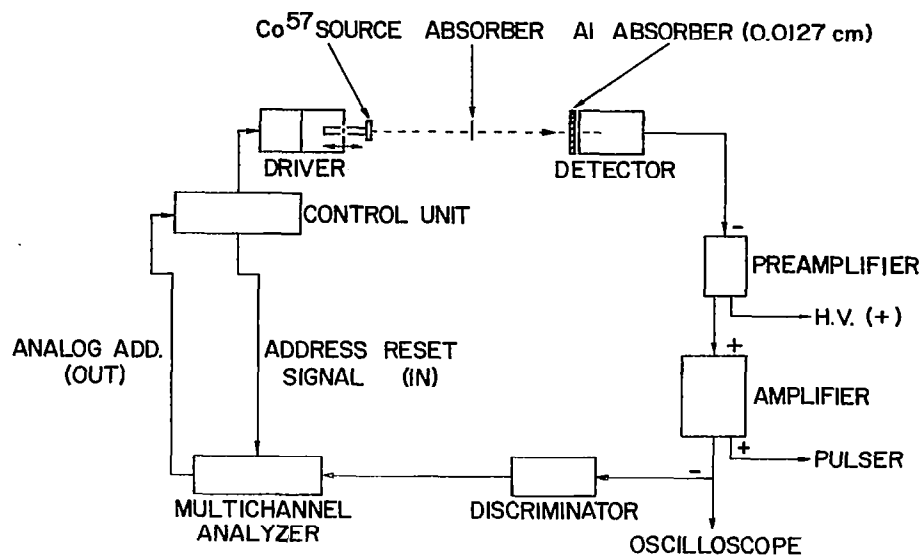


Figure 3.- Schematic diagram of experimental setup for measuring Mössbauer spectra.

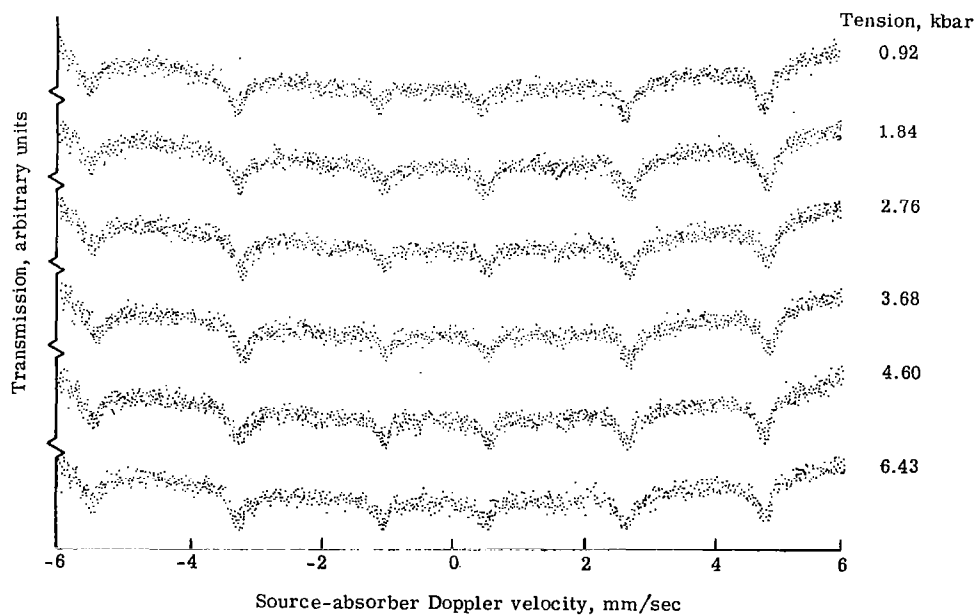


Figure 4.- Mössbauer spectra in carbon-rich steel absorber sample under different tensions. 38- μm -thick AISI C1095 steel.

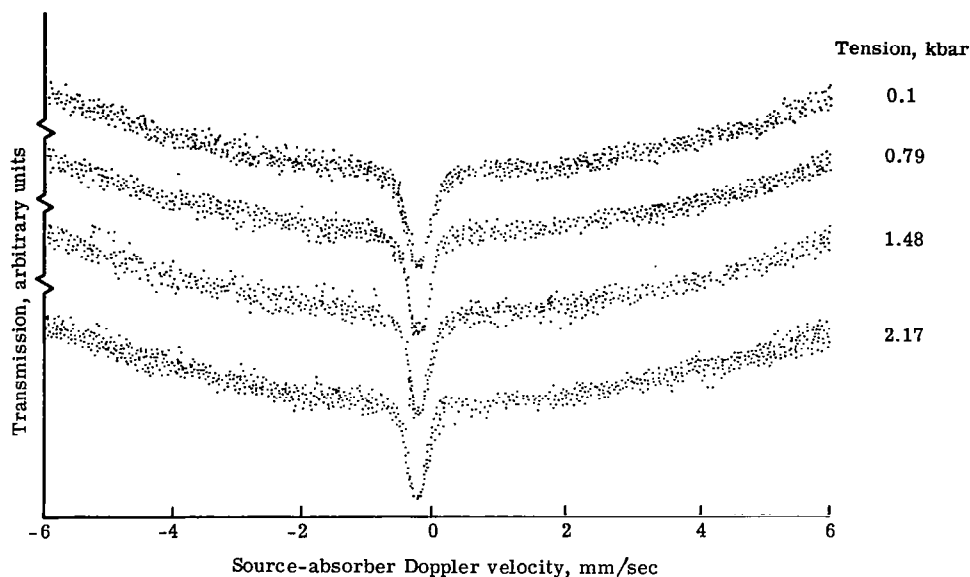


Figure 5.- Mössbauer spectra of stainless steel under different tensions. 25- μ m-thick, 5.08-cm-wide type 316 steel.

program, and the values of various parameters (isomer shift, quadropole splitting, $g\mu H$, I_1/I_2 , and resonant fraction) were calculated. The parameters are defined in the section entitled "Output," and the results are summarized in table I.

From figures 4 and 5, it is obvious that only a detailed computer analysis can reliably estimate small stress-induced changes in the Mössbauer spectra. A comparison of the present results with similar data reported elsewhere (refs. 9 to 12) and summarized in table I verifies the usefulness of the present program in obtaining reliable estimates of such small changes in the associated Mössbauer parameters. From these data, it may be concluded that I_1/I_2 for carbon-rich steels and the resonant fraction for nickel-chromium steels are the most stress-sensitive parameters. These parameters can serve as the basis of remote uniaxial tension measurements in respective steel structures.

CONCLUDING REMARKS

The least-squares curve-fitting techniques described in this report apply to single-line spectra, single hyperfine spectra, or when the constituent spectra are separated well enough to let the individual absorption peaks stand alone. In most well-tempered structural steels, one usually encounters uniform composition leading to a single hyperfine spectrum or biphase materials leading to two distinctly separate spectra. If, however, one is concerned with a complex spectrum resulting from the existence of several local

TABLE I.- COMPARISON OF PRESENT RESULTS WITH REPORTED MEASUREMENTS ON PRESSURE DEPENDENCE OF MÖSSBAUER PARAMETERS

Mössbauer parameter ^a	Reference 9	Reference 10	Reference 11	Reference 12	Present results ^b	
					AISI C1095	Type 316
Isomer shift (IS), cm-sec ⁻¹ -kbar ⁻¹	$(-7.98 \pm 0.31) \times 10^{-5}$	$(1.78 \pm 0.56) \times 10^{-4}$	-8.3×10^{-5}	$(-7.9 \pm 0.8) \times 10^{-5}$	$(-7.19 \pm 2.89) \times 10^{-5}$	$(-8.69 \pm 5.02) \times 10^{-5}$
Quadrupole splitting (QS), cm-sec ⁻¹ -kbar ⁻¹	-----	0	$<7 \times 10^{-4}$	$(0.96 \pm 0.23) \times 10^{-5}$	$(1.06 \pm 1.52) \times 10^{-5}$	-----
$g\mu H$ (GO1), cm-sec ⁻¹ -kbar ⁻¹	-----	$(-1.74 \pm 1.91) \times 10^{-5}$	$(-1.69 \pm 0.05) \times 10^{-4}$	$(-1.34 \pm 0.25) \times 10^{-4}$	$(-7.61 \pm 5.03) \times 10^{-5}$	-----
I_1/I_2 (M1), kbar ⁻¹	-----	-----	Not reported	≈ 0.01 (for 1 to 10 kbar)	$(-3.62 \pm 1.36) \times 10^{-2}$	-----
Resonant fraction (PHI2), kbar ⁻¹	-----	-----	-----	-----	$(-5.62 \pm 1.98) \times 10^{-5}$	$(-2.59 \pm 1.12) \times 10^{-4}$

^aFORTTRAN output heading is given in parentheses after each parameter.

^bThe quoted errors on the various coefficients include the effects of individual data point errors.

environments in the absorber iron alloy, the curve-fitting process becomes more complex and will require several trial-and-error solutions based on homogeneous alloy peaks. In that case one should use the procedure of curve fitting of the Mössbauer data by constrained least-squares analysis, as mentioned earlier in this report. The present program has not been adapted for such complex cases.

Langley Research Center,
National Aeronautics and Space Administration,
Hampton, Va., February 22, 1972.

APPENDIX A

THE LEAST-SQUARES SOLUTION

The solution of equation (7) contains $3N + 3$ parameters, which under theoretical conditions are constant. These parameters are $a, b, c, A_1, p_1, \lambda_1, \dots, A_N, p_N,$ and λ_N . A solution of equation (7) can be found with n observations. Associated with y in equation (7) is some measurement error ϵ . Since this error exists, a computational method is needed which yields the best possible results with all the information available. The method of least squares, which is described subsequently, uses a minimum error criterion and has been used in the analysis of these Mössbauer data.

In general, equation (7) with the associated measurement errors can be written as

$$y_i = F(x_i, a, b, c, A_1, p_1, \lambda_1, \dots, A_N, p_N, \lambda_N) + \epsilon_i \quad (A1)$$

where F is a nonlinear function of the parameters, and in order to find an estimate to the parameters of the function, it must be linearized. Expanding equation (7) in a Taylor series about a nominal set of parameters and dropping the higher order terms result in the following linear approximation:

$$\begin{aligned} \Delta y_i &= y_i - y_{i,0} \\ &= b_{i,1}(a - a_0) + b_{i,2}(b - b_0) + b_{i,3}(c - c_0) + b_{i,4}(A_1 - A_{1,0}) \\ &\quad + b_{i,5}(p_1 - p_{1,0}) + b_{i,6}(\lambda_1 - \lambda_{1,0}) + \dots + b_{i,3N+1}(A_N - A_{N,0}) \\ &\quad + b_{i,3N+2}(p_N - p_{N,0}) + b_{i,3N+3}(\lambda_N - \lambda_{N,0}) + \epsilon_i \end{aligned} \quad (A2)$$

APPENDIX A – Continued

where

$$\begin{array}{ccc}
 b_{i,1} = \left. \frac{\partial F_i}{\partial a} \right|_0 & b_{i,2} = \left. \frac{\partial F_i}{\partial b} \right|_0 & b_{i,3} = \left. \frac{\partial F_i}{\partial c} \right|_0 \\
 b_{i,4} = \left. \frac{\partial F_i}{\partial A_1} \right|_0 & b_{i,5} = \left. \frac{\partial F_i}{\partial p_1} \right|_0 & b_{i,6} = \left. \frac{\partial F_i}{\partial \lambda_1} \right|_0 \\
 \cdot & \cdot & \cdot \\
 \cdot & \cdot & \cdot \\
 \cdot & \cdot & \cdot \\
 b_{i,3N+1} = \left. \frac{\partial F_i}{\partial A_N} \right|_0 & b_{i,3N+2} = \left. \frac{\partial F_i}{\partial p_N} \right|_0 & b_{i,3N+3} = \left. \frac{\partial F_i}{\partial \lambda_N} \right|_0
 \end{array}$$

If α_j is equal to the $3N + 3$ parameters and

$$\begin{array}{ccc}
 \Delta\alpha_1 = a - a_0 & \Delta\alpha_2 = b - b_0 & \Delta\alpha_3 = c - c_0 \\
 \Delta\alpha_4 = A_1 - A_{1,0} & \Delta\alpha_5 = p_1 - p_{1,0} & \Delta\alpha_6 = \lambda_1 - \lambda_{1,0} \\
 \cdot & \cdot & \cdot \\
 \cdot & \cdot & \cdot \\
 \cdot & \cdot & \cdot \\
 \Delta\alpha_{3N+1} = A_N - A_{N,0} & \Delta\alpha_{3N+2} = p_N - p_{N,0} & \Delta\alpha_{3N+3} = \lambda_N - \lambda_{N,0}
 \end{array}$$

equation (A2) can be put into the following form:

$$\Delta y_i = \sum_{j=1}^{3N+3} b_{i,j} \Delta\alpha_j + \epsilon_i \quad (i = 1, \dots, n) \quad (A3)$$

For further considerations the linear equation (A3) corresponding to the i th observation is expressed in matrix notation as

APPENDIX A – Continued

$$z_i = B_i \Delta\alpha + e_i \quad (A4)$$

where

$$z_i = \Delta y_i \quad B_i = \begin{bmatrix} b_{i,1}, b_{i,2}, \dots, b_{i,3N+3} \end{bmatrix}$$

$$\Delta\alpha = \begin{bmatrix} \Delta\alpha_1 \\ \Delta\alpha_2 \\ \cdot \\ \cdot \\ \cdot \\ \Delta\alpha_{3N+3} \end{bmatrix} \quad e_i = \begin{bmatrix} \epsilon_i \end{bmatrix}$$

Then for n ($n \geq 3N + 3$) observations, there are n matrix equations of the form of equation (A4) which may be written

$$\bar{z} = \bar{B} \Delta\alpha + \bar{e} \quad (A5)$$

where

$$\bar{z} = \begin{bmatrix} z_1 \\ z_2 \\ \cdot \\ \cdot \\ \cdot \\ z_n \end{bmatrix} \quad \bar{B} = \begin{bmatrix} B_1 \\ B_2 \\ \cdot \\ \cdot \\ \cdot \\ B_n \end{bmatrix} \quad \bar{e} = \begin{bmatrix} e_1 \\ e_2 \\ \cdot \\ \cdot \\ \cdot \\ e_n \end{bmatrix}$$

The problem may be restated: Given \bar{z} and \bar{B} , find the best estimate $\hat{\Delta\alpha}$ for $\Delta\alpha$.

The best estimate $\hat{\Delta\alpha}$ is the value of $\Delta\alpha$ which minimizes the sum of the squares of the residuals $\bar{e}^T \bar{e}$ where

APPENDIX A – Continued

$$\bar{\mathbf{e}}^T \bar{\mathbf{e}} = (\bar{\mathbf{z}} - \bar{\mathbf{B}} \Delta \alpha)^T (\bar{\mathbf{z}} - \bar{\mathbf{B}} \Delta \alpha) \quad (\text{A6})$$

In order to minimize equation (A6), the first variation δ with respect to $\Delta \alpha$ must vanish, that is,

$$\left. \begin{aligned} \delta(\bar{\mathbf{e}}^T \bar{\mathbf{e}}) &= \delta \left[(\bar{\mathbf{z}} - \bar{\mathbf{B}} \Delta \alpha)^T (\bar{\mathbf{z}} - \bar{\mathbf{B}} \Delta \alpha) \right] = 0 \\ \delta(\bar{\mathbf{e}}^T \bar{\mathbf{e}}) &= -2(\bar{\mathbf{z}}^T - \Delta \alpha^T \bar{\mathbf{B}}^T) \bar{\mathbf{B}} \delta \Delta \alpha = 0 \end{aligned} \right\} \quad (\text{A7})$$

Since $\delta \Delta \alpha \neq 0$, equations (A7) can be satisfied if

$$(\bar{\mathbf{z}}^T - \Delta \alpha^T \bar{\mathbf{B}}^T) \bar{\mathbf{B}} = 0$$

or

$$\bar{\mathbf{B}}^T \bar{\mathbf{B}} \Delta \alpha = \bar{\mathbf{B}}^T \bar{\mathbf{z}} \quad (\text{A8})$$

Solving for the estimate of $\Delta \alpha$ in equation (A8) gives

$$\hat{\Delta \alpha} = (\bar{\mathbf{B}}^T \bar{\mathbf{B}})^{-1} \bar{\mathbf{B}}^T \bar{\mathbf{z}} \quad (\text{A9})$$

A second necessary condition for equation (A6) to be a minimum is that the second variation with respect to $\Delta \alpha$ be positive definite. Upon examination the second variation is

$$\delta^2(\bar{\mathbf{e}}^T \bar{\mathbf{e}}) = 2\delta \Delta \alpha^T \bar{\mathbf{B}}^T \bar{\mathbf{B}} \delta \Delta \alpha$$

which is positive definite. Therefore, equation (A9) is a valid expression for $\hat{\Delta \alpha}$.

Since equation (A9) is based on a linear approximation with nominal $\alpha_{j,0}$, $\hat{\Delta \alpha}$ can be used to find the best estimates $\hat{\alpha}_j$. With the relationship $\alpha = \alpha_0 + \Delta \alpha$, the value of $\hat{\Delta \alpha}$ which minimized equation (A6) leads to a new nominal $\alpha_{j,0} = \alpha_{j,0} + \hat{\Delta \alpha}$. This process implies an iterative procedure which continues until $\hat{\Delta \alpha} \rightarrow 0$ and the value of $\alpha_{j,0}$ that leads to this result is the best estimate of $\hat{\alpha}_j$ for α_j .

APPENDIX A – Continued

Error Analysis

Associated with the least-squares solution is the determination of the accuracy of the parameters α . When $\hat{\Delta}\alpha \rightarrow 0$ the best estimate of α is obtained. This estimate is denoted by $\hat{\alpha}^*$ and the associated matrix $\left[\overline{\mathbf{B}}^T \overline{\mathbf{B}}\right]^{-1*}$ is defined to be the covariance matrix. Multiplying $\left[\overline{\mathbf{B}}^T \overline{\mathbf{B}}\right]^{-1*}$ by the predicted variance σ^2 , where

$$\sigma^2 = \frac{\bar{\mathbf{e}}^T \bar{\mathbf{e}}}{(n - k)}$$

yields the covariance matrix \mathbf{V} of the estimated parameters (ref. 13),

$$\mathbf{V} = \left[\overline{\mathbf{B}}^T \overline{\mathbf{B}}\right]^{-1*} \sigma^2$$

By examining the diagonal elements of \mathbf{V} , estimates of the error in α can be obtained. That is, the square roots of the diagonal elements of \mathbf{V} are the estimates of the error bounds of α .

Partial Derivatives

For equation (A1)

$$F = (ax^2 + bx + c) + \sum_{j=1}^N \frac{A_j}{1 + \left(\frac{p_j - x}{\lambda_j}\right)^2}$$

where $\lambda_j = \Gamma_j/2$, the partial derivatives of F with respect to each parameter are as follows:

APPENDIX A - Concluded

$$\frac{\partial F}{\partial a} = x^2$$

$$\frac{\partial F}{\partial b} = x$$

$$\frac{\partial F}{\partial c} = 1$$

$$\left. \begin{aligned} \frac{\partial F}{\partial A_j} &= \frac{\lambda_j^2}{\lambda_j^2 + (p_j - x)^2} \\ \frac{\partial F}{\partial p_j} &= \frac{-2A_j \lambda_j^2 (p_j - x)}{[\lambda_j^2 + (p_j - x)^2]^2} \\ \frac{\partial F}{\partial \lambda_j} &= \frac{2A_j \lambda_j (p_j - x)^2}{[\lambda_j^2 + (p_j - x)^2]^2} \end{aligned} \right\} \quad (j = 1, 2, \dots, N)$$

APPENDIX B

LANGLEY LIBRARY SUBROUTINE MATINV

Language: FORTRAN

Purpose: MATINV solves the matrix equation $AX = B$, where A is a square coefficient matrix and B is a matrix of constant vectors. The solution to a set of simultaneous equations, the matrix inverse, and the determinant may be obtained. If the user does not want the inverse, use SIMEQ for savings in time and storage. For the determinant only, use DETEV.

Use: CALL MATINV(A,N,B,M,DETERM,IPIVOT,INDEX,NMAX,ISCALE)

A	A two-dimensional array of the coefficients. On return to the calling program, A^{-1} is stored in A
N	The order of A, $1 \leq N \leq NMAX$
B	A two-dimensional array of the constant vectors B. On return to the calling program, X is stored in B
M	The number of column vectors in B. The expression $M = 0$ signals that the subroutine is used solely for inversion; however, in the CALL statement an entry corresponding to B must still be present
DETERM	Gives the value of the determinant by the formula $DET(A) = (10^{100})ISCALE(DETERM)$
IPIVOT	A one-dimensional array of temporary storage used by the routine
INDEX	A two-dimensional array of temporary storage used by the routine
NMAX	The maximum order of A as stated in the DIMENSION statement of the calling program
ISCALE	A scale factor computed by the subroutine to keep the results of computation within the floating-point word size of the computer

Restrictions: Arrays A, B, IPIVOT, and INDEX have variable dimensions in the subroutine. The maximum size of these arrays must be specified in a DIMENSION statement of the calling program as A(NMAX,NMAX), B(NMAX,M), IPIVOT(NMAX), and INDEX(NMAX,2). The original matrices A and B are destroyed. They must be saved by the user if there is further need for them. The determinant is set to zero for a singular matrix.

Method: Jordan's method is used to reduce a matrix A to the identity matrix I through a succession of elementary transformations I_n, I_{n-1}, \dots, I_1 . $A = I$. If these transformations are simultaneously applied to I and to a matrix B of constant vectors, the results are A^{-1} and X where $AX = B$. Each transformation is selected so that the largest element is used in the pivotal position. (See ref. (a).)

Accuracy: Total pivotal strategy is used to minimize the rounding errors; however, the accuracy of the final results depends upon how well-conditioned the original matrix is.

Reference: (a) Fox, L.: An Introduction to Numerical Linear Algebra. Oxford Univ. Press, 1965.

Storage: 542g locations.

Subroutine date: August 1, 1968.

APPENDIX C

SAMPLE CASES

Sample Case 1

Input.-

```
$NAME IFLAG=1, IERR=1, IPRINT=1,
NP=1, AQ=3000, PD=-.2, CCAND=.2, ERROR=6*1.E-6,
SAO=10, BO=3, VELB=6, %
```

```
1 -903
2 44664 3 44760 4 44705 5 44639 6 44612 7 44670 8 44415 9 44142
10 43965 11 44242 12 43662 13 44123 14 44000 15 44170 16 44028 17 44200
18 43714 19 44588 20 44124 21 44495 22 44132 23 44060 24 44266 25 44102
26 44257 27 44392 28 44004 29 44161 30 44279 31 44343 32 44000 33 44232
34 44200 35 44200 36 44000 37 44000 38 43849 39 43892 40 44050 41 44102
42 43696 43 44155 44 44015 45 43848 46 43877 47 43863 48 43613 49 43732
50 43839 51 43689 52 44156 53 43941 54 43681 55 43710 56 43726 57 43581
58 44013 59 43985 60 43662 61 43707 62 43723 63 43978 64 43939 65 43846
66 43982 67 43990 68 43688 69 43800 70 43352 71 43244 72 43629 73 43395
74 44020 75 43671 76 43409 77 43384 78 43617 79 43700 80 43736 81 43721
82 43581 83 43683 84 43705 85 43340 86 43550 87 43628 88 43459 89 43555
90 43638 91 43101 92 43222 93 43476 94 43333 95 43555 96 43156 97 43007
98 43604 99 43502 100 43602 101 43163 102 43834 103 43613 104 42965 105 43296
106 43445 107 43301 108 43607 109 43199 110 43495 111 43644 112 43093 113 43616
114 43184 115 43718 116 43370 117 43022 118 43318 119 43696 120 43240 121 43220
122 43120 123 43360 124 43141 125 43174 126 43019 127 43007 128 43212 129 43630
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138 42947 139 43137 140 43275 141 43181 142 43011 143 43298 144 43060 145 42940
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162 43156 163 42779 164 42354 165 42811 166 43167 167 42530 168 42539 169 42744
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218 42525 219 42523 220 42961 221 42164 222 42372 223 42738 224 42804 225 42441
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234 42122 235 42306 236 42637 237 42288 238 42360 239 42549 240 42518 241 42230
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338 42385 339 41726 340 41843 341 41438 342 42271 343 41963 344 41925 345 41787
346 42436 347 42000 348 41920 349 41883 350 41797 351 41790 352 42125 353 41804
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354	41575	355	41874	356	41614	357	41618	358	42043	359	41803	360	41915	361	41687
362	41848	363	41845	364	41735	365	41723	366	41862	367	41824	368	41682	369	41962
370	41884	371	41859	372	41618	373	42040	374	42270	375	41716	376	41651	377	41430
378	41765	379	41662	380	41779	381	41717	382	41857	383	41629	384	41910	385	41468
386	41645	387	41986	388	42013	389	41903	390	41825	391	42181	392	41804	393	41944
394	41935	395	41575	396	42013	397	41882	398	42094	399	41925	400	41518	401	41545
402	42087	403	42145	404	41532	405	41952	406	41795	407	41562	408	41930	409	42094
410	41246	411	41535	412	42256	413	41790	414	42085	415	41758	416	41809	417	42071
418	41890	419	41523	420	42054	421	42193	422	41894	423	41851	424	41634	425	41669
426	41599	427	41782	428	41621	429	41909	430	41854	431	42170	432	42032	433	42230
434	42235	435	41952	436	41591	437	42156	438	41996	439	42014	440	42126	441	41879
442	41415	443	42185	444	41620	445	42183	446	41734	447	42030	448	42057	449	42329
450	41676	451	42292	452	42545	453	42789	454	42601	455	43089	456	42983	457	43112
459	42936	459	42834	460	43294	461	43275	462	43867	463	44003	464	43966	465	44666
466	44846	467	44684	468	45054	469	45397	470	45297	471	45495	472	45467	473	46027
474	45587	475	45670	476	45351	477	45239	478	45700	479	45547	480	45788	481	44800
482	44981	483	44347	484	44400	485	44228	486	44093	487	43692	488	43824	489	43381
490	43129	491	42981	492	43138	493	42623	494	42771	495	42581	496	42646	497	42455
498	42405	499	42371	500	42121	501	42484	502	42190	503	42127	504	41993	505	42008
506	42083	507	41862	508	42264	509	41921	510	41973	511	42062	512	42056	513	41992
514	41585	515	41660	516	41558	517	41985	518	41494	519	41596	520	41660	521	41940
522	41592	523	41771	524	41513	525	41697	526	41628	527	41457	528	41624	529	41659
530	41601	531	41866	532	41530	533	41415	534	41818	535	41718	536	41854	537	41551
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546	41726	547	41862	548	41937	549	42207	550	42077	551	41327	552	41764	553	41650
554	42054	555	41693	556	41455	557	41635	558	42040	559	41918	560	41521	561	41757
562	41928	563	41805	564	41526	565	41577	566	41648	567	41177	568	42020	569	41619
570	41715	571	42225	572	41552	573	41523	574	41940	575	41959	576	41801	577	41724
578	41402	579	41937	580	41450	581	41564	582	41423	583	41752	584	41932	585	41794
586	41363	587	41445	588	41311	589	41561	590	41927	591	41505	592	41602	593	41678
594	41711	595	41600	596	41565	597	41524	598	41527	599	41835	600	41728	601	41897
602	41729	603	41488	604	41614	605	41883	606	41942	607	41480	608	41720	609	41503
610	41759	611	41458	612	41570	613	41807	614	41973	615	41415	616	41598	617	41919
618	41624	619	42149	620	41825	621	41651	622	42063	623	41668	624	41988	625	41577
626	41737	627	41753	628	41764	629	41834	630	41939	631	41696	632	41647	633	41770
634	41738	635	41901	636	41855	637	42163	638	41852	639	42117	640	41853	641	41983
642	41821	643	41455	644	42069	645	41875	646	41683	647	42032	648	42229	649	41981
650	41953	651	42034	652	41753	653	41708	654	41668	655	42048	656	42029	657	41398
658	41876	659	41849	660	41476	661	41931	662	42237	663	41547	664	41770	665	42172
666	41737	667	41798	668	42060	669	41925	670	42247	671	41680	672	41800	673	41913
674	42014	675	42116	676	42046	677	42077	678	41700	679	41687	680	42161	681	41741
682	41828	683	41971	684	42050	685	42043	686	42013	687	42000	688	41676	689	41982
690	42035	691	42115	692	42053	693	41963	694	42081	695	41813	696	41650	697	41715
698	42066	699	42000	700	42000	701	42086	702	41963	703	42000	704	42396	705	42027
706	41963	707	42041	708	42157	709	41963	710	41923	711	42290	712	41884	713	42191
714	42334	715	42235	716	42043	717	42176	718	42257	719	41890	720	41839	721	42131
722	42056	723	42335	724	42140	725	42114	726	42035	727	42028	728	42234	729	41914
730	41880	731	42021	732	42307	733	42152	734	41982	735	42130	736	42415	737	42173
738	41851	739	42305	740	42227	741	42391	742	41740	743	42253	744	42438	745	42068
746	42391	747	42054	748	42181	749	42557	750	42191	751	42283	752	42249	753	42494
754	42014	755	42849	756	42035	757	42407	758	42508	759	42490	760	42555	761	42205
762	42374	763	42171	764	42358	765	42217	766	42567	767	42530	768	42241	769	42021
770	42488	771	42550	772	42242	773	42480	774	42206	775	42546	776	42325	777	42117
778	42527	779	42214	780	42758	781	42157	782	42302	783	42412	784	42600	785	42991
786	42419	787	41976	788	42208	789	42944	790	42465	791	42665	792	42618	793	42384
794	42537	795	42588	796	42516	797	42804	798	42557	799	42418	800	42308	801	42719
802	42241	803	42805	804	42678	805	42634	806	42511	807	42944	808	42527	809	42924
810	42644	811	42600	812	42302	813	42760	814	42940	815	42653	816	42816	817	42742
818	42765	819	42574	820	42755	821	43221	822	42628	823	42664	824	42773	825	42946
826	43017	827	42669	828	42647	829	42430	830	42822	831	42695	832	43027	833	42810
834	42723	835	42635	836	42353	837	43016	838	43043	839	42911	840	42445	841	42983
842	42742	843	42889	844	42058	845	43284	846	42811	847	42866	848	42711	849	43299
850	43031	851	42856	852	42013	853	42806	854	43125	855	42872	856	42626	857	43070
858	43127	859	43062	860	43305	861	43349	862	42073	863	43225	864	42751	865	42509

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995 43674 996 43678 997 43682 998 43686 999 43690 1000 43694
$NAM1
  IFLAG=0,
  IPRINT=0,
  IERR=2,
$
$NAM1
  IERR=3,
$

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Output with tables printed.- The computer values given below do not include the velocity calibration correction factor of 1.274. Figure 6 is included as a sample computer plot.

CASE NO. 1 IERR= 1

COEFFICIENTS OF PARABOLA $Y = SA \cdot X^2 + B \cdot X + C$
 $SA = 7.87263350E+01$ ($\mp 6.815E-01$) $B = -8.05921646E+00$ ($\mp 1.926E+00$) $C = 4.15600451E+04$ ($\mp 1.187E+01$)

NO. OF ITERATIONS= 9

PARAMETERS FOR PEAK 1

$IS = -2.82731447E-01$ $GAM = 2.90415888E-01$

$A = 4.32422708E+03$ ($\mp 6.853E+01$) $P = -2.82731447E-01$ ($\mp 2.300E-03$) $CGAM = 1.45207944E-01$ ($\mp 3.545E-03$) $AREA = 1.94218988E+03$

$PHI1 = 1.04026244E-01$ $PHI2 = 3.80778889E-03$ $PHI1/PHI2 = 2.73193308E+01$

CHANNEL NO.	X MM/SEC	Y	COMPUTED Y	RESIDUALS	PARABOLA
1	-6.00000000E+00	4.46640000E+04	4.44453360E+04	2.18663971E+02	4.44425484E+04
2	-5.98790323E+00	4.47600000E+04	4.44338339E+04	3.26166131E+02	4.44310344E+04
3	-5.97580645E+00	4.47050000E+04	4.44223548E+04	2.82645176E+02	4.44195435E+04
4	-5.96370968E+00	4.46390000E+04	4.44108989E+04	2.28101104E+02	4.44080756E+04
5	-5.95161290E+00	4.46120000E+04	4.43994661E+04	4.12533916E+02	4.43966307E+04
6	-5.93951613E+00	4.46700000E+04	4.43880564E+04	2.81943610E+02	4.43852089E+04
7	-5.92741935E+00	4.46150000E+04	4.43766698E+04	3.83301849E+01	4.43738101E+04
8	-5.91532258E+00	4.41420000E+04	4.43653064E+04	-2.23306359E+02	4.43624344E+04
9	-5.90322581E+00	4.39650000E+04	4.43539660E+04	-3.88966022E+02	4.43510817E+04
10	-5.89112903E+00	4.42420000E+04	4.43426488E+04	-1.00648806E+02	4.43397520E+04
11	-5.87903226E+00	4.36620000E+04	4.43313547E+04	-6.69354711E+02	4.43284454E+04
12	-5.86693548E+00	4.41230000E+04	4.43200837E+04	-1.97083738E+02	4.43171618E+04
13	-5.85483871E+00	4.40000000E+04	4.43088659E+04	-3.08835887E+02	4.43059012E+04
14	-5.84274194E+00	4.41700000E+04	4.42976112E+04	-1.27611159E+02	4.42946637E+04

15	-5.83064516E+00	4.40280000E+04	4.42864096E+04	-2.58409555E+02	4.42834493E+04
16	-5.81854839E+00	4.42000000E+04	4.42752311E+04	-7.52310764E+01	4.42722579E+04
17	-5.80645161E+00	4.37140000E+04	4.42640757E+04	-5.50075723E+02	4.42610895E+04
18	-5.79435484E+00	4.45880000E+04	4.42529435E+04	3.35056505E+02	4.42499441E+04
19	-5.78225806E+00	4.41240000E+04	4.42418344E+04	-1.17834395E+02	4.42388218E+04
20	-5.77016129E+00	4.44950000E+04	4.42307484E+04	2.64251578E+02	4.42277226E+04
21	-5.75806452E+00	4.44132000E+04	4.42196856E+04	-8.76855775E+01	4.42166464E+04
22	-5.74596774E+00	4.40600000E+04	4.42086459E+04	-1.48645862E+02	4.42055932E+04
23	-5.73387097E+00	4.42660000E+04	4.41976293E+04	6.83707229E+01	4.41945630E+04
24	-5.72177419E+00	4.41020000E+04	4.41866358E+04	-8.46358226E+01	4.41835559E+04
25	-5.70967742E+00	4.42570000E+04	4.41756655E+04	8.13345002E+01	4.41725719E+04
26	-5.69758065E+00	4.43920000E+04	4.41647183E+04	2.27281691E+02	4.41616109E+04
27	-5.68548387E+00	4.40040000E+04	4.41537943E+04	-1.49794252E+02	4.41506729E+04
28	-5.67338710E+00	4.41610000E+04	4.41428933E+04	1.81066707E+01	4.41397579E+04
29	-5.66129032E+00	4.42790000E+04	4.41320155E+04	1.46984459E+02	4.41288660E+04
30	-5.64919355E+00	4.43430000E+04	4.41211609E+04	2.21839111E+02	4.41179972E+04
31	-5.63709677E+00	4.40000000E+04	4.41103294E+04	-1.10329373E+02	4.41071514E+04
32	-5.62500000E+00	4.42320000E+04	4.40995210E+04	1.32479005E+02	4.40963286E+04
33	-5.61290323E+00	4.42000000E+04	4.40887358E+04	1.11264245E+02	4.40855289E+04
34	-5.60080645E+00	4.42000000E+04	4.40779737E+04	1.22026345E+02	4.40747522E+04
35	-5.58870568E+00	4.40000000E+04	4.40672347E+04	-6.72346945E+01	4.40639985E+04
36	-5.57661290E+00	4.40000000E+04	4.40565189E+04	-5.65188753E+01	4.40532679E+04
37	-5.56451613E+00	4.38490000E+04	4.40458262E+04	-1.96826198E+02	4.40425603E+04
38	-5.55241935E+00	4.38920000E+04	4.40351567E+04	-1.43156664E+02	4.40318758E+04
39	-5.54032258E+00	4.40500000E+04	4.40245103E+04	2.54897264E+01	4.40212143E+04
40	-5.52822581E+00	4.41020000E+04	4.40138870E+04	8.81129718E+01	4.40105758E+04
41	-5.51612903E+00	4.36960000E+04	4.40032869E+04	-3.07286929E+02	4.39999604E+04
42	-5.50403226E+00	4.41550000E+04	4.39927100E+04	1.62290024E+02	4.39893681E+04
43	-5.49193548E+00	4.40150000E+04	4.39821562E+04	3.28438292E+01	4.39787987E+04
44	-5.47983871E+00	4.38480000E+04	4.39716255E+04	-1.23625515E+02	4.39682524E+04
45	-5.46774194E+00	4.38770000E+04	4.39611180E+04	-8.41180081E+01	4.39577292E+04
46	-5.45564516E+00	4.38630000E+04	4.39506337E+04	-8.76336525E+01	4.39472290E+04
47	-5.44354839E+00	4.36130000E+04	4.39401724E+04	-3.27172449E+02	4.39367519E+04
48	-5.43145161E+00	4.37320000E+04	4.39297344E+04	-1.97734398E+02	4.39262977E+04
49	-5.41935484E+00	4.38390000E+04	4.39193195E+04	-8.03195011E+01	4.39158666E+04
50	-5.40725806E+00	4.36890000E+04	4.39089278E+04	-2.19327759E+02	4.39054585E+04
51	-5.39516129E+00	4.41560000E+04	4.38985592E+04	2.57440826E+02	4.38950735E+04
52	-5.38306452E+00	4.39410000E+04	4.38982137E+04	5.27862548E+01	4.38847116E+04
53	-5.37096774E+00	4.36810000E+04	4.38778915E+04	-1.96891475E+02	4.38743726E+04
54	-5.35887097E+00	4.37100000E+04	4.38675924E+04	-1.57592364E+02	4.38640567E+04
55	-5.34677419E+00	4.37260000E+04	4.38573164E+04	-1.31316414E+02	4.38537639E+04
56	-5.33467742E+00	4.35310000E+04	4.38470636E+04	-2.66063626E+02	4.38434941E+04
57	-5.32258065E+00	4.40130000E+04	4.38368340E+04	1.76165909E+02	4.38332473E+04
58	-5.31048387E+00	4.39850000E+04	4.38266275E+04	1.58372461E+02	4.38230236E+04
59	-5.29838710E+00	4.36620000E+04	4.38164442E+04	-1.54444243E+02	4.38128229E+04
60	-5.28629032E+00	4.37070000E+04	4.38062841E+04	-9.92841139E+01	4.38026453E+04
61	-5.27419355E+00	4.37230000E+04	4.37961472E+04	-7.31471521E+01	4.37924906E+04
62	-5.26209677E+00	4.35780000E+04	4.37860334E+04	1.91966641E+02	4.37823591E+04
63	-5.25000000E+00	4.39390000E+04	4.37759427E+04	1.63057263E+02	4.37722506E+04
64	-5.23790323E+00	4.38460000E+04	4.37658753E+04	8.01247144E+01	4.37621651E+04
65	-5.22580645E+00	4.39820000E+04	4.37558310E+04	2.26168993E+02	4.37521026E+04
66	-5.21370968E+00	4.35900000E+04	4.37458099E+04	2.44190097E+02	4.37420632E+04
67	-5.20161290E+00	4.36880000E+04	4.37358120E+04	-4.78119739E+01	4.37320469E+04
68	-5.18951613E+00	4.38000000E+04	4.37258372E+04	7.41627783E+01	4.37220535E+04
69	-5.17741935E+00	4.33520000E+04	4.37158856E+04	-3.63885648E+02	4.37120833E+04
70	-5.16532258E+00	4.32440000E+04	4.37059573E+04	-4.61957253E+02	4.37021360E+04
71	-5.15322581E+00	4.36290000E+04	4.36960520E+04	-6.70520388E+01	4.36922138E+04
72	-5.14112903E+00	4.33950000E+04	4.36861700E+04	-2.91170007E+02	4.36823106E+04
73	-5.12903226E+00	4.40200000E+04	4.36763112E+04	3.43688841E+02	4.36724325E+04
74	-5.11693548E+00	4.36710000E+04	4.36664755E+04	4.52450420E+00	4.36625774E+04
75	-5.10483871E+00	4.34090000E+04	4.36566630E+04	-2.47663019E+02	4.36527454E+04
76	-5.09274194E+00	4.35840000E+04	4.36468737E+04	3.37126269E+02	4.36429364E+04
77	-5.08064516E+00	4.36170000E+04	4.36371076E+04	-2.01076314E+01	4.36331504E+04
78	-5.06854839E+00	4.37000000E+04	4.36273647E+04	7.26352768E+01	4.36233875E+04

79	-5.05645161E+00	4.37360000E+04	4.36176450E+04	1.18354993E+02	4.36136476E+04
80	-5.04435484E+00	4.37210000E+04	4.36079485E+04	1.13051514E+02	4.36039308E+04
81	-5.03225806E+00	4.35810000E+04	4.35982752E+04	-1.72751597E+01	4.35942370E+04
82	-5.02016129E+00	4.36830000E+04	4.35886250E+04	9.43749692E+01	4.35845662E+04
83	-5.00806452E+00	4.37050000E+04	4.35789981E+04	1.26001859E+02	4.35749185E+04
84	-4.99596774E+00	4.33400000E+04	4.35693944E+04	-2.29394371E+02	4.35652939E+04
85	-4.98387097E+00	4.35500000E+04	4.35598138E+04	-9.81384336E+00	4.35556922E+04
86	-4.971777419E+00	4.36280000E+04	4.35502565E+04	7.77434805F+01	4.35461136E+04
87	-4.95967742E+00	4.34590000E+04	4.35407224E+04	-8.17224010E+01	4.35365581E+04
88	-4.94758065E+00	4.35550000E+04	4.35312115E+04	2.37885103E+01	4.35270255E+04
89	-4.93548387E+00	4.36380000E+04	4.35217238E+04	1.16276213E+02	4.35175161F+04
90	-4.92338710E+00	4.31010000E+04	4.35122593E+04	-4.11259255E+02	4.35080296E+04
91	-4.91129032E+00	4.33320000E+04	4.35028180E+04	-1.70818016E+02	4.34985662E+04
92	-4.89919355E+00	4.34760000E+04	4.34934000E+04	-1.73999507E+01	4.34891255F+04
93	-4.88709677E+00	4.33330000E+04	4.34840051E+04	-1.51005101E+02	4.34797086E+04
94	-4.87500000E+00	4.35550000E+04	4.34746335E+04	8.03665299E+01	4.34703143E+04
95	-4.86290323E+00	4.31560000E+04	4.34652851E+04	-3.09285059E+02	4.34609431E+04
96	-4.85080645E+00	4.30070000E+04	4.34559599E+04	-4.48959869E+02	4.34515949E+04
97	-4.83870568E+00	4.36040000E+04	4.34466579E+04	1.57342098E+02	4.34422697E+04
98	-4.82661290E+00	4.35020000E+04	4.34373792E+04	6.46208384E+01	4.34329676E+04
99	-4.81451613E+00	4.36020000E+04	4.34281236E+04	1.73876352E+02	4.34236885E+04
100	-4.80241935E+00	4.31630000E+04	4.34188914E+04	-2.55891365F+02	4.34144325E+04
101	-4.79032258E+00	4.38340000E+04	4.34096823E+04	4.24317688E+02	4.34051099E+04
102	-4.77822581E+00	4.36130000E+04	4.34004965E+04	2.12503506E+02	4.33959806E+04
103	-4.76612903E+00	4.25650000E+04	4.33913339E+04	-4.26333911E+02	4.33868026E+04
104	-4.75403226E+00	4.33960000E+04	4.33821946E+04	1.38054344E+01	4.33776388E+04
105	-4.74193548E+00	4.34450000E+04	4.33730785E+04	7.19215396E+01	4.33684979E+04
106	-4.72983871E+00	4.33010000E+04	4.33639856E+04	-6.29855973E+01	4.33593802E+04
107	-4.71774194E+00	4.36070000E+04	4.33549160E+04	2.52084021E+02	4.33502854E+04
108	-4.70564516E+00	4.31990000E+04	4.33458696E+04	-1.46869606E+02	4.33412137F+04
109	-4.69354839E+00	4.34950000E+04	4.33368465E+04	1.58153517E+02	4.33321650F+04
110	-4.68145161E+00	4.36440000E+04	4.33278466E+04	3.16153300E+02	4.33231354E+04
111	-4.66935484E+00	4.30930000E+04	4.33188700E+04	-2.25869992E+02	4.33141368E+04
112	-4.65725806E+00	4.36160000E+04	4.33099166E+04	3.06083372E+02	4.33051573E+04
113	-4.64516129E+00	4.31840000E+04	4.33009865E+04	-1.16986523E+02	4.32962008E+04
114	-4.63306452E+00	4.37180000E+04	4.32920797E+04	4.25920321E+02	4.32872673E+04
115	-4.62096774E+00	4.33700000E+04	4.32831961E+04	8.68039024E+01	4.32783569E+04
116	-4.60887097E+00	4.30220000E+04	4.32743358E+04	-2.52335782E+02	4.32694695E+04
117	-4.59677419E+00	4.33180000E+04	4.32654987E+04	5.25012661E+01	4.32606051E+04
118	-4.58467742E+00	4.36960000E+04	4.32566850E+04	4.39315043E+02	4.32517638E+04
119	-4.57258065E+00	4.32400000E+04	4.32478945E+04	-7.89445272E+00	4.32429456E+04
120	-4.56048387E+00	4.32200000E+04	4.32391272E+04	-1.91272246E+01	4.32341503E+04
121	-4.54838710E+00	4.31200000E+04	4.32303833E+04	-1.10383275E+02	4.32253782E+04
122	-4.53629032E+00	4.33800000E+04	4.32216626E+04	1.58337394E+02	4.32166290E+04
123	-4.52419355E+00	4.31410000E+04	4.32129652F+04	-7.19652270E+01	4.32079029F+04
124	-4.51209677E+00	4.31740000E+04	4.32042911E+04	-3.02911243E+01	4.31991998E+04
125	-4.50000000E+00	4.30190000E+04	4.31956403E+04	-1.76640316E+02	4.31905198F+04
126	-4.48790323E+00	4.30070000E+04	4.31870128E+04	-1.80012800E+02	4.31818628E+04
127	-4.47580645E+00	4.32120000E+04	4.31784086E+04	3.35914199E+01	4.31732289E+04
128	-4.46370968E+00	4.36300000E+04	4.31698277F+04	4.60172342E+02	4.31646180E+04
129	-4.45161290E+00	4.31920000E+04	4.31612700E+04	3.07299627E+01	4.31560301E+04
130	-4.43951613E+00	4.31080000E+04	4.31527357E+04	-4.47357208E+01	4.31474653E+04
131	-4.42741935E+00	4.31130000E+04	4.31442247E+04	-3.12247118E+01	4.31389235E+04
132	-4.41532258E+00	4.33160000E+04	4.31357370E+04	1.80262987E+02	4.31304048E+04
133	-4.40322581E+00	4.30660000E+04	4.31272726E+04	-6.12726284E+01	4.31219091E+04
134	-4.39112903E+00	4.32020000E+04	4.31189316E+04	8.31684395E+01	4.31134364E+04
135	-4.37903226E+00	4.30990000E+04	4.31104138E+04	-1.14138128E+01	4.31049868E+04
136	-4.36693548E+00	4.29930000E+04	4.31020194E+04	-1.09019389E+02	4.30965652E+04
137	-4.35483871E+00	4.29470000E+04	4.30936483E+04	-1.46648291E+02	4.30881567E+04
138	-4.34274194E+00	4.31370000E+04	4.30853005E+04	5.16994759E+01	4.30797762E+04
139	-4.33064516E+00	4.32750000E+04	4.30769761E+04	1.98023909E+02	4.30714187E+04
140	-4.31854839E+00	4.31810000E+04	4.30686750E+04	1.12325005E+02	4.30630843E+04
141	-4.30645161E+00	4.30110000E+04	4.30603972E+04	-4.93972393E+01	4.30547729E+04

142	-4.29435484E+00	4.32980000E+04	4.30521428E+04	2.45857172E+02	4.30464846E+04
143	-4.28225806E+00	4.30600000E+04	4.30439118E+04	1.60882343E+01	4.30382193E+04
144	-4.27016129E+00	4.29400000E+04	4.30357041E+04	-9.57040548E+01	4.30299770E+04
145	-4.25806452E+00	4.31290000E+04	4.30275197E+04	1.01480300E+02	4.30217578E+04
146	-4.24596774E+00	4.27000000E+04	4.30193587E+04	-3.19358704E+02	4.30135617E+04
147	-4.23387097E+00	4.27610000E+04	4.30112211E+04	-2.50221071E+02	4.30053885E+04
148	-4.22177419E+00	4.32570000E+04	4.30031068E+04	2.53893194E+02	4.29972384E+04
149	-4.20967742E+00	4.29020000E+04	4.29950159E+04	-9.30159126E+01	4.29891114E+04
150	-4.19758065E+00	4.33630000E+04	4.29869484E+04	3.76051606E+02	4.29810074E+04
151	-4.18548387E+00	4.25780000E+04	4.29789043E+04	-9.04255845E-01	4.29729264E+04
152	-4.17338710E+00	4.31950000E+04	4.29708835E+04	2.24116499E+02	4.29648685E+04
153	-4.16129032E+00	4.24550000E+04	4.29628861E+04	-5.07886134E+02	4.29568336E+04
154	-4.14919355E+00	4.31490000E+04	4.29549122E+04	1.94087840E+02	4.29488217E+04
155	-4.13709677E+00	4.31020000E+04	4.29469616E+04	1.55038417E+02	4.29408329E+04
156	-4.12500000E+00	4.27690000E+04	4.29390344E+04	-1.70034407E+02	4.29328671E+04
157	-4.11290323E+00	4.26570000E+04	4.29311306E+04	-7.41306371E+01	4.29249244E+04
158	-4.10080645E+00	4.29500000E+04	4.29232503E+04	2.67497224E+01	4.29170047E+04
159	-4.08870968E+00	4.30190000E+04	4.29153933E+04	1.03606667E+02	4.29091080E+04
160	-4.07661290E+00	4.28300000E+04	4.29075598E+04	-7.75598093E+01	4.29012344E+04
161	-4.06451613E+00	4.31560000E+04	4.28997497E+04	2.56250290E+02	4.28933839E+04
162	-4.05241935E+00	4.27790000E+04	4.28919630E+04	-1.12963041E+02	4.28855563E+04
163	-4.04032258E+00	4.23540000E+04	4.28841998E+04	-5.30199806E+02	4.28777518E+04
164	-4.02822581E+00	4.28110000E+04	4.28764600E+04	-6.54600113E+01	4.28699704E+04
165	-4.01612903E+00	4.31670000E+04	4.28687437E+04	2.98256338E+02	4.28622120E+04
166	-4.00403226E+00	4.25300000E+04	4.28610508E+04	-3.31050762E+02	4.28544766E+04
167	-3.99193548E+00	4.25390000E+04	4.28533813E+04	-3.14381319E+02	4.28467643E+04
168	-3.97983871E+00	4.27440000E+04	4.28457353E+04	-1.01735336E+02	4.28390750E+04
169	-3.96774194E+00	4.31680000E+04	4.28381128E+04	3.29887179E+02	4.28314088E+04
170	-3.95564516E+00	4.29900000E+04	4.28305138E+04	1.59486223E+02	4.28237656E+04
171	-3.94354839E+00	4.25900000E+04	4.28229382E+04	-2.32938212E+02	4.28161454E+04
172	-3.93145161E+00	4.27510000E+04	4.28153861E+04	-6.43861298E+01	4.28085483E+04
173	-3.91935484E+00	4.27620000E+04	4.28078575E+04	-4.58575377E+01	4.28009742E+04
174	-3.90725806E+00	4.26050000E+04	4.28003524E+04	-1.95352441E+02	4.27934231E+04
175	-3.89516129E+00	4.26040000E+04	4.27928708E+04	-1.88870846E+02	4.27858951E+04
176	-3.88306452E+00	4.29220000E+04	4.27854128E+04	1.36587240E+02	4.27783902E+04
177	-3.87096774E+00	4.27210000E+04	4.27779782E+04	-5.69781870E+01	4.27709082E+04
178	-3.85887097E+00	4.26150000E+04	4.27705671E+04	-1.55567135E+02	4.27634493E+04
179	-3.84677419E+00	4.22800000E+04	4.27631796E+04	-4.83179610E+02	4.27560135E+04
180	-3.83467742E+00	4.28580000E+04	4.27558156E+04	1.02184381E+02	4.27486007E+04
181	-3.82258065E+00	4.26570000E+04	4.27484752E+04	-9.14751687E+01	4.27412109E+04
182	-3.81048387E+00	4.24820000E+04	4.27411583E+04	-2.59158266E+02	4.27338442E+04
183	-3.79838710E+00	4.26000000E+04	4.27338649E+04	-1.33864917E+02	4.27265005E+04
184	-3.78629032E+00	4.25220000E+04	4.27265951E+04	-2.04595129E+02	4.27191799E+04
185	-3.77419355E+00	4.23350000E+04	4.27193489E+04	-3.84348911E+02	4.27118823E+04
186	-3.76209677E+00	4.28430000E+04	4.27121263E+04	1.30873732E+02	4.27046077E+04
187	-3.75000000E+00	4.26310000E+04	4.27049272E+04	-7.39272084E+01	4.26973562E+04
188	-3.73790323E+00	4.23300000E+04	4.26977517E+04	-3.67751740E+02	4.26901277E+04
189	-3.72580645E+00	4.27700000E+04	4.26905999E+04	7.94001294E+01	4.26829223E+04
190	-3.71370968E+00	4.30370000E+04	4.26834716E+04	3.53528392E+02	4.26757399E+04
191	-3.70161290E+00	4.26350000E+04	4.26763670E+04	-4.13669594E+01	4.26685805E+04
192	-3.68951613E+00	4.29210000E+04	4.26692859E+04	2.51714066E+02	4.26614442E+04
193	-3.67741935E+00	4.24630000E+04	4.26622285E+04	-1.99228540E+02	4.26543309E+04
194	-3.66532258E+00	4.25800000E+04	4.26551948E+04	-7.51947846E+01	4.26472407E+04
195	-3.65322581E+00	4.29750000E+04	4.26481847E+04	3.26815322E+02	4.26401735E+04
196	-3.64112903E+00	4.26430000E+04	4.26411982E+04	1.80177211E+00	4.26331293E+04
197	-3.62903226E+00	4.28780000E+04	4.26342354E+04	2.43764556E+02	4.26261082E+04
198	-3.61693548E+00	4.27790000E+04	4.26272963E+04	1.51703666E+02	4.26191101E+04
199	-3.60483871E+00	4.26370000E+04	4.26203809E+04	1.66190910E+01	4.26121351E+04
200	-3.59274194E+00	4.29960000E+04	4.26134892E+04	3.82510823E+02	4.26051831E+04
201	-3.58064516E+00	4.25520000E+04	4.26066211E+04	-5.46211483E+01	4.25982542E+04
202	-3.56854839E+00	4.27790000E+04	4.25997768E+04	1.79223168E+02	4.25913482E+04
203	-3.55645161E+00	4.26310000E+04	4.25929562E+04	3.80437613E+01	4.25844654E+04
204	-3.54435484E+00	4.25720000E+04	4.25861594E+04	-1.41593781E+01	4.25776055E+04
205	-3.53225806E+00	4.25270000E+04	4.25793863E+04	-5.23862605E+01	4.25707687E+04

206	-3.52016129E+00	4.29200000E+04	4.25726369E+04	3.47363103E+02	4.25639550E+04
207	-3.50806452E+00	4.29100000E+04	4.25659113E+04	3.44088703E+02	4.25571643E+04
208	-3.49596774E+00	4.26090000E+04	4.25592095E+04	4.97905278E+01	4.25503966E+04
209	-3.48387097E+00	4.24360000E+04	4.25525314E+04	-1.16531434E+02	4.25436520E+04
210	-3.47177419E+00	4.27360000E+04	4.25458772E+04	1.90122807E+02	4.25369304E+04
211	-3.45967742E+00	4.26940000E+04	4.25392468E+04	1.54753239E+02	4.25302318E+04
212	-3.44758065E+00	4.26840000E+04	4.25326402E+04	1.51359850E+02	4.25235563E+04
213	-3.43548387E+00	4.27900000E+04	4.25260574E+04	2.63942628E+02	4.25169038E+04
214	-3.42338710E+00	4.21920000E+04	4.25194984E+04	-3.27498439E+02	4.25102744E+04
215	-3.41129032E+00	4.25400000E+04	4.25129634E+04	2.70366374E+01	4.25036680E+04
216	-3.39919355E+00	4.25050000E+04	4.25064522E+04	-1.45215661E+00	4.24970847E+04
217	-3.38709677E+00	4.25250000E+04	4.24999648E+04	2.50351665E+01	4.24905243E+04
218	-3.37500000E+00	4.25230000E+04	4.24935014E+04	2.94985935E+01	4.24839871E+04
219	-3.36290323E+00	4.25610000E+04	4.24870619E+04	7.39381110E+01	4.24774728E+04
220	-3.35080645E+00	4.21640000E+04	4.24806463E+04	-3.16646295E+02	4.24709817E+04
221	-3.33870968E+00	4.23720000E+04	4.24742546E+04	-1.02254638E+02	4.24645135E+04
222	-3.32661290E+00	4.27380000E+04	4.24678869E+04	2.70113068E+02	4.24580684E+04
223	-3.31451613E+00	4.28040000E+04	4.24615432E+04	3.42456808E+02	4.24516463E+04
224	-3.30241935E+00	4.24410000E+04	4.24552234E+04	-1.42234326E+01	4.24452473E+04
225	-3.29032258E+00	4.26450000E+04	4.24489277E+04	1.96072331E+02	4.24388713E+04
226	-3.27822581E+00	4.22180000E+04	4.24426559E+04	-2.24655917E+02	4.24325184E+04
227	-3.26612903E+00	4.26920000E+04	4.24364082E+04	2.55591808E+02	4.24261885E+04
228	-3.25403226E+00	4.23030000E+04	4.24301845E+04	-1.27184509E+02	4.24198816E+04
229	-3.24193548E+00	4.25400000E+04	4.24239849E+04	1.16015114E+02	4.24135978E+04
230	-3.22983871E+00	4.21210000E+04	4.24178093E+04	-2.96809339E+02	4.24073370E+04
231	-3.21774194E+00	4.25740000E+04	4.24116579E+04	1.62342115E+02	4.24010992E+04
232	-3.20564516E+00	4.24070000E+04	4.24055305E+04	1.46945880E+00	4.23948845E+04
233	-3.19354839E+00	4.21220000E+04	4.23994273E+04	-2.77427326E+02	4.23886929E+04
234	-3.18145161E+00	4.23060000E+04	4.23933483E+04	-8.73482566E+01	4.23825242E+04
235	-3.16935484E+00	4.26370000E+04	4.23872934E+04	2.49706648E+02	4.23763787E+04
236	-3.15725806E+00	4.22880000E+04	4.23812626E+04	-9.32626315E+01	4.23702561E+04
237	-3.14516129E+00	4.23600000E+04	4.23752561E+04	-1.52561138E+01	4.23641566E+04
238	-3.13306452E+00	4.25490000E+04	4.23692738E+04	1.79726181E+02	4.23580802E+04
239	-3.12096774E+00	4.25180000E+04	4.23633158E+04	1.54684233E+02	4.23520267E+04
240	-3.10887097E+00	4.22300000E+04	4.23573820E+04	-1.27381978E+02	4.23459963E+04
241	-3.09677419E+00	4.21830000E+04	4.23514725E+04	-1.68472473E+02	4.23399890E+04
242	-3.08467742E+00	4.23670000E+04	4.23455873E+04	2.14127260E+01	4.23340047E+04
243	-3.07258065E+00	4.25200000E+04	4.23397264E+04	1.80273597E+02	4.23280434E+04
244	-3.06048387E+00	4.25650000E+04	4.23338899E+04	2.31110119E+02	4.23221052E+04
245	-3.04838710E+00	4.22460000E+04	4.23280777E+04	-8.20777331E+01	4.23161900E+04
246	-3.03629032E+00	4.21960000E+04	4.23222900E+04	-1.26289981E+02	4.23102979E+04
247	-3.02419355E+00	4.23260000E+04	4.23165266E+04	9.47335126E+00	4.23044288E+04
248	-3.01209677E+00	4.21730000E+04	4.23107878E+04	-1.37787761E+02	4.22985827E+04
249	-3.00000000E+00	4.25220000E+04	4.23050733E+04	2.16926657E+02	4.22927597E+04
250	-2.98790323E+00	4.24300000E+04	4.22993834E+04	1.30616580E+02	4.22869597E+04
251	-2.97580645E+00	4.21920000E+04	4.22937180E+04	-1.01718017E+02	4.22811828E+04
252	-2.96370968E+00	4.21710000E+04	4.22880772E+04	-1.17077163E+02	4.22754289E+04
253	-2.95161290E+00	4.25630000E+04	4.22824609E+04	2.80539117E+02	4.22696981E+04
254	-2.93951613E+00	4.18640000E+04	4.22768692E+04	-4.12869206E+02	4.22639902E+04
255	-2.92741935E+00	4.21250000E+04	4.22713022E+04	-1.46302160E+02	4.22583055E+04
256	-2.91532258E+00	4.25170000E+04	4.22657598E+04	2.51240225E+02	4.22526437E+04
257	-2.90322581E+00	4.22680000E+04	4.22602421E+04	7.75791985E+00	4.22470050E+04
258	-2.89112903E+00	4.26030000E+04	4.22547491E+04	3.48250894E+02	4.22413894E+04
259	-2.87903226E+00	4.23900000E+04	4.22492809E+04	1.40719116E+02	4.22357968E+04
260	-2.86693548E+00	4.23160000E+04	4.22438374E+04	7.21625543E+01	4.22302727E+04
261	-2.85483871E+00	4.26220000E+04	4.22384188E+04	3.83581176E+02	4.22246806E+04
262	-2.84274194E+00	4.22300000E+04	4.22330251E+04	-3.02505289E+00	4.22191572E+04
263	-2.83064516E+00	4.20870000E+04	4.22276562E+04	-1.40656166E+02	4.22136567E+04
264	-2.81854839E+00	4.26060000E+04	4.22223122E+04	3.83687801E+02	4.22081793E+04
265	-2.80645161E+00	4.27990000E+04	4.22169932E+04	5.82006813E+02	4.22027249E+04
266	-2.79435484E+00	4.19200000E+04	4.22116992E+04	-2.91699167E+02	4.21972936E+04
267	-2.78225806E+00	4.25700000E+04	4.22064302E+04	3.63569823E+02	4.21918853E+04
268	-2.77016129E+00	4.21130000E+04	4.22011863E+04	-8.81862555E+01	4.21865000E+04
269	-2.75806452E+00	4.20400000E+04	4.21959674E+04	-1.55967442E+02	4.21811378E+04

270	-2.74596774E+00	4.21050000E+04	4.21907738E+04	-8.57737770E+01	4.21757987E+04
271	-2.73387097E+00	4.23260000E+04	4.21856053E+04	1.40394698E+02	4.21704825E+04
272	-2.72177419E+00	4.20860000E+04	4.21804621E+04	-9.44620591E+01	4.21651894E+04
273	-2.70567742E+00	4.19850000E+04	4.21753441E+04	-1.90344092E+02	4.21559194E+04
274	-2.69758065E+00	4.19190000E+04	4.21702514E+04	-2.51251446E+02	4.21546724E+04
275	-2.68548387E+00	4.21070000E+04	4.21651842E+04	-5.81841665E+01	4.21494484E+04
276	-2.67338710E+00	4.21630000E+04	4.21601423E+04	7.85770005E+00	4.21442475E+04
277	-2.66129032E+00	4.22320000E+04	4.21551259E+04	7.68741052E+01	4.21390696E+04
278	-2.64919355E+00	4.21870000E+04	4.21501350E+04	3.68649996E+01	4.21339147E+04
279	-2.63709677E+00	4.19950000E+04	4.21451697E+04	-1.50169667E+02	4.21287829E+04
280	-2.62500000E+00	4.22650000E+04	4.21402299E+04	1.24770053E+02	4.21236742E+04
281	-2.61290323E+00	4.17760000E+04	4.21351159E+04	-3.59315893E+02	4.21185884E+04
282	-2.60080645E+00	4.21560000E+04	4.21304276E+04	2.55724392E+01	4.21135257E+04
283	-2.58870968E+00	4.21900000E+04	4.21255650E+04	6.44349949E+01	4.21084861E+04
284	-2.57661250E+00	4.24440000E+04	4.21207283E+04	3.23271716E+02	4.21034695E+04
285	-2.56451613E+00	4.24760000E+04	4.21159175E+04	3.60082544E+02	4.20984759E+04
286	-2.55241935E+00	4.18560000E+04	4.21111326E+04	-2.55132583E+02	4.20935054E+04
287	-2.54032258E+00	4.19110000E+04	4.21063737E+04	-1.95373725E+02	4.20885579E+04
288	-2.52822581E+00	4.21430000E+04	4.21016409E+04	4.13590519E+01	4.20836335E+04
289	-2.51612903E+00	4.21890000E+04	4.20969343E+04	9.20656834E+01	4.20787321E+04
290	-2.50403226E+00	4.22310000E+04	4.20922539E+04	1.38746102E+02	4.20738537E+04
291	-2.49193548E+00	4.24100000E+04	4.20875998E+04	3.22400238E+02	4.20689984E+04
292	-2.47983871E+00	4.22910000E+04	4.20829720E+04	2.08028021E+02	4.20641661E+04
293	-2.46774194E+00	4.20230000E+04	4.20783706E+04	-5.53706224E+01	4.20593568E+04
294	-2.45564516E+00	4.21280000E+04	4.20737958E+04	5.42042327E+01	4.20545706E+04
295	-2.44354839E+00	4.18730000E+04	4.20692475E+04	-1.96247491E+02	4.20498075E+04
296	-2.43145161E+00	4.22110000E+04	4.20647259E+04	1.46274128E+02	4.20450674E+04
297	-2.41935484E+00	4.19940000E+04	4.20602310E+04	-6.62309923E+01	4.20403503E+04
298	-2.40725806E+00	4.20910000E+04	4.20557629E+04	3.52370640E+01	4.20356562E+04
299	-2.39516129E+00	4.20970000E+04	4.20513218E+04	4.56782108E+01	4.20309852E+04
300	-2.38306452E+00	4.19730000E+04	4.20469076E+04	-7.39076404E+01	4.20263373E+04
301	-2.37096774E+00	4.18620000E+04	4.20425206E+04	-1.80520581E+02	4.20217124E+04
302	-2.35887097E+00	4.21900000E+04	4.20381607E+04	1.51839295E+02	4.20171105E+04
303	-2.34677419E+00	4.23760000E+04	4.20338281E+04	3.42171892E+02	4.20125316E+04
304	-2.33467742E+00	4.21010000E+04	4.20295229E+04	7.14771088E+01	4.20079758E+04
305	-2.32258065E+00	4.22060000E+04	4.20252452E+04	1.80754844E+02	4.20034431E+04
306	-2.31048387E+00	4.21330000E+04	4.20209950E+04	1.12004993E+02	4.19989334E+04
307	-2.29838710E+00	4.20000000E+04	4.20167726E+04	-1.67725542E+01	4.19944467E+04
308	-2.28629032E+00	4.21220000E+04	4.20125779E+04	1.09422091E+02	4.19899830E+04
309	-2.27419355E+00	4.18320000E+04	4.20084112E+04	-1.76411185E+02	4.19855424E+04
310	-2.26209677E+00	4.18250000E+04	4.20042725E+04	-1.79272504E+02	4.19811249E+04
311	-2.25000000E+00	4.23870000E+04	4.20001620E+04	3.86838015E+02	4.19767304E+04
312	-2.23790323E+00	4.21530000E+04	4.19960798E+04	1.56920244E+02	4.19723589E+04
313	-2.22580645E+00	4.21780000E+04	4.19920259E+04	1.85974054E+02	4.19680105E+04
314	-2.21370968E+00	4.23280000E+04	4.19880007E+04	3.39999310E+02	4.19636851E+04
315	-2.20161290E+00	4.20440000E+04	4.19840041E+04	5.99958754E+01	4.19593827E+04
316	-2.18951613E+00	4.18030000E+04	4.19800364E+04	-1.77036393E+02	4.19551034E+04
317	-2.17741935E+00	4.20820000E+04	4.19760976E+04	1.05902357E+02	4.19508471E+04
318	-2.16532258E+00	4.19120000E+04	4.19721880E+04	-6.01880256E+01	4.19466139E+04
319	-2.15322581E+00	4.20780000E+04	4.19683077E+04	1.09692303E+02	4.19424037E+04
320	-2.14112903E+00	4.19590000E+04	4.19644568E+04	-5.45681938E+00	4.19382165E+04
321	-2.12903226E+00	4.18440000E+04	4.19606356E+04	-1.16635559E+02	4.19340524E+04
322	-2.11693548E+00	4.17930000E+04	4.19568441E+04	-1.63844089E+02	4.19299113E+04
323	-2.10483871E+00	4.21350000E+04	4.19530826E+04	1.81917414E+02	4.19257933E+04
324	-2.09274194E+00	4.18710000E+04	4.19493512E+04	-7.83512351E+01	4.19216983E+04
325	-2.08064516E+00	4.21200000E+04	4.19456502E+04	1.74349774E+02	4.19176264E+04
326	-2.06854839E+00	4.17120000E+04	4.19419798E+04	-2.29979754E+02	4.19135775E+04
327	-2.05645161E+00	4.20020000E+04	4.19383400E+04	6.36599765E+01	4.19095516E+04
328	-2.04435484E+00	4.19310000E+04	4.19347312E+04	-3.73124355E+00	4.19055488E+04
329	-2.03225806E+00	4.16680000E+04	4.19311536E+04	-2.63153631E+02	4.19015690E+04
330	-2.02016129E+00	4.16300000E+04	4.19276074E+04	-2.97607412E+02	4.18976122E+04
331	-2.00806452E+00	4.21350000E+04	4.19240928E+04	2.60907184E+02	4.18936785E+04
332	-1.99596774E+00	4.20400000E+04	4.19206101E+04	1.19389914E+02	4.18897678E+04
333	-1.98387097E+00	4.19310000E+04	4.19171595E+04	1.38405298E+01	4.18858802E+04

334	-1.97177419E+00	4.18920000E+04	4.19137412E+04	-2.17412256E+01	4.18820156E+04
335	-1.95967742E+00	4.22450000E+04	4.19103556E+04	3.34644380E+02	4.18781741E+04
336	-1.94758065E+00	4.20030000E+04	4.19070029E+04	9.59970715E+01	4.18743556E+04
337	-1.93548387E+00	4.23850000E+04	4.19036834E+04	4.81316561E+02	4.18705601E+04
338	-1.92338710E+00	4.17260000E+04	4.19003974E+04	-1.74397448E+02	4.18667877E+04
339	-1.91129032E+00	4.18430000E+04	4.18971453E+04	-5.41452625E+01	4.18630383E+04
340	-1.89919355E+00	4.14380000E+04	4.18949772E+04	-4.55927203E+02	4.18593119E+04
341	-1.88709677E+00	4.22710000E+04	4.18907436E+04	3.80256401E+02	4.18556086E+04
342	-1.87500000E+00	4.18630000E+04	4.18875948E+04	-2.45947959E+01	4.18519284E+04
343	-1.86290323E+00	4.19250000E+04	4.18844811E+04	4.05188512E+01	4.18482711E+04
344	-1.85080645E+00	4.17870000E+04	4.18814030E+04	-9.44030280E+01	4.18446370E+04
345	-1.83870968E+00	4.24380000E+04	4.18783608E+04	5.59639182E+02	4.18410258E+04
346	-1.82661290E+00	4.20000000E+04	4.18753549E+04	1.24645083E+02	4.18374377E+04
347	-1.81451613E+00	4.19200000E+04	4.18723857E+04	4.76142591E+01	4.18338726E+04
348	-1.80241935E+00	4.18890000E+04	4.18694537E+04	1.95462804E+01	4.18303306E+04
349	-1.79032258E+00	4.17970000E+04	4.18665593E+04	-6.95593015E+01	4.18268116E+04
350	-1.77822581E+00	4.17900000E+04	4.18637030E+04	-7.37029521E+01	4.18233157E+04
351	-1.76612903E+00	4.21250000E+04	4.18608852E+04	2.64114844E+02	4.18198428E+04
352	-1.75403226E+00	4.18040000E+04	4.18581064E+04	-5.41064173E+01	4.18163929E+04
353	-1.74193548E+00	4.15750000E+04	4.18553673E+04	-2.80367261E+02	4.18129661E+04
354	-1.72983871E+00	4.18740000E+04	4.18526682E+04	2.13317679E+01	4.18095623E+04
355	-1.71774154E+00	4.16140000E+04	4.18500099E+04	-2.360099C1E+02	4.18061816E+04
356	-1.70564516E+00	4.16180000E+04	4.18473929E+04	-2.29392859E+02	4.18028239E+04
357	-1.69354839E+00	4.20430000E+04	4.18448177E+04	1.98182274E+02	4.17994892E+04
358	-1.68145161E+00	4.18030000E+04	4.18422851E+04	-3.92851432E+01	4.17961776E+04
359	-1.66935484E+00	4.19150000E+04	4.18397958E+04	7.52042161E+01	4.17928890E+04
360	-1.65725806E+00	4.16870000E+04	4.18373503E+04	-1.50350348E+02	4.17896235E+04
361	-1.64516129E+00	4.18480000E+04	4.18349496E+04	1.30504329E+01	4.17863810E+04
362	-1.63306452E+00	4.18450000E+04	4.18325942E+04	1.24057959E+01	4.17831615E+04
363	-1.62096774E+00	4.17390000E+04	4.18302851E+04	-9.12850561E+01	4.17799651E+04
364	-1.60887097E+00	4.17230000E+04	4.18280230E+04	-1.05022956E+02	4.17767917E+04
365	-1.59677419E+00	4.18620000E+04	4.18258088E+04	3.61912259E+01	4.17736414E+04
366	-1.58467742E+00	4.18240000E+04	4.18236434E+04	3.56579612E-01	4.17705141E+04
367	-1.57258065E+00	4.16820000E+04	4.18215278E+04	-1.39527847E+02	4.17674098E+04
368	-1.56048387E+00	4.19620000E+04	4.18194630E+04	1.42536951E+02	4.17643286E+04
369	-1.54838710E+00	4.18840000E+04	4.18174501E+04	6.65499302E+01	4.17612704E+04
370	-1.53629032E+00	4.19390000E+04	4.18154900E+04	1.23509999E+02	4.17582353E+04
371	-1.52419355E+00	4.16180000E+04	4.18135840E+04	-1.95583986E+02	4.17552232E+04
372	-1.51209677E+00	4.20400000E+04	4.18117332E+04	2.28266777E+02	4.17522342E+04
373	-1.50000000E+00	4.22700000E+04	4.18099390E+04	4.60061029E+02	4.17492681E+04
374	-1.48790323E+00	4.17160000E+04	4.18082025E+04	-9.22025460E+01	4.17463252E+04
375	-1.47580645E+00	4.16510000E+04	4.18065253E+04	-1.55525333E+02	4.17434052E+04
376	-1.46370968E+00	4.14300000E+04	4.18049088E+04	-3.74908786E+02	4.17405083E+04
377	-1.45161290E+00	4.17650000E+04	4.18033544E+04	-3.83544293E+01	4.17376345E+04
378	-1.43951613E+00	4.16620000E+04	4.18018639E+04	-1.39863868E+02	4.17347827E+04
379	-1.42741935E+00	4.17790000E+04	4.18004388E+04	-2.14387878E+01	4.17319559E+04
380	-1.41532258E+00	4.17170000E+04	4.17990810E+04	-8.20809636E+01	4.17291512E+04
381	-1.40322581E+00	4.18570000E+04	4.17977923E+04	5.92077378E+01	4.17263695E+04
382	-1.39112903E+00	4.16230000E+04	4.17965747E+04	-1.67574650E+02	4.17236108E+04
383	-1.37903226E+00	4.18100000E+04	4.17954302E+04	1.45698013E+01	4.17208752E+04
384	-1.36693548E+00	4.14680000E+04	4.17943611E+04	-3.26361052E+02	4.17181626E+04
385	-1.35483871E+00	4.16450000E+04	4.17933696E+04	-1.48369633E+02	4.17154731E+04
386	-1.34274194E+00	4.18860000E+04	4.17924583E+04	9.35417473E+01	4.17128066E+04
387	-1.33064516E+00	4.20130000E+04	4.17916295E+04	2.21370483E+02	4.17101632E+04
388	-1.31854839E+00	4.18030000E+04	4.17908861E+04	1.21138621E+01	4.17075428E+04
389	-1.30645161E+00	4.18250000E+04	4.17902310E+04	3.47690189E+01	4.17049454E+04
390	-1.29435484E+00	4.21810000E+04	4.17896671E+04	3.91332921E+02	4.17023711E+04
391	-1.28225806E+00	4.18040000E+04	4.17891976E+04	1.48023610E+01	4.16998189E+04
392	-1.27016129E+00	4.19440000E+04	4.1788261E+04	1.55173939E+02	4.16972915E+04
393	-1.25806452E+00	4.19350000E+04	4.17885559E+04	1.46444055E+02	4.16947863E+04
394	-1.24596774E+00	4.15750000E+04	4.17883911E+04	-2.13391110E+02	4.16923042E+04
395	-1.23387097E+00	4.20130000E+04	4.17883356E+04	2.24664393E+02	4.16898450E+04
396	-1.22177419E+00	4.18820000E+04	4.17883937E+04	9.36062552E+01	4.16874089E+04
397	-1.20967742E+00	4.20940000E+04	4.17885701E+04	3.05429919E+02	4.16849959E+04

398	-1.19758065E+0C	4.19250000E+04	4.17888695E+04	1.36130510E+J2	4.16826059E+04
399	-1.18548387E+CC	4.15180000E+04	4.17892971E+04	-2.71297139E+02	4.16802389E+04
400	-1.17338710E+0C	4.15450000E+04	4.17895858E+04	-2.44858538E+02	4.16778950E+04
401	-1.16129C32E+CC	4.2C870000E+04	4.17905596E+04	2.96440446E+02	4.16755741E+04
402	-1.14919355E+00	4.21450000E+04	4.17914064E+04	3.53593550E+02	4.16732763E+04
403	-1.13709677E+00	4.15320000E+04	4.17924059E+04	-2.604059C5E+02	4.16710015E+04
404	-1.12500000E+00	4.15520000E+04	4.17935651E+04	1.58434942E+02	4.16687497E+04
405	-1.11290323E+00	4.17950000E+04	4.17948915E+04	1.08462012E-01	4.16665210E+04
406	-1.10080645E+0C	4.15620000E+04	4.17963935E+04	-2.34393509E+02	4.16643153E+04
407	-1.08870968E+00	4.19300000E+04	4.17980797E+04	1.31920286E+02	4.16621326E+04
408	-1.07661290E+0C	4.2C940000E+04	4.17999595E+04	2.94040476E+02	4.16599730E+04
409	-1.06451613E+0C	4.12460000E+04	4.18020430E+04	-5.56042951E+02	4.16578365E+04
410	-1.05241935E+0C	4.15380000E+04	4.18043409E+04	-2.66340911E+02	4.16557230E+04
411	-1.04032258E+00	4.22960000E+04	4.18068649E+04	4.89135113E+02	4.16536375E+04
412	-1.02822581E+0C	4.17900000E+04	4.18096274E+04	-1.96274013E+01	4.16515650E+04
413	-1.01612903E+0C	4.2C830000E+04	4.18126419E+04	2.70358103E+02	4.16495206E+04
414	-1.00403226E+00	4.17590000E+04	4.18159229E+04	-5.79228673E+01	4.16474993E+04
415	-9.91935484E-01	4.18090000E+04	4.18194860E+04	-1.04859504E+01	4.16455010E+04
416	-9.75838710E-01	4.20710000E+04	4.18233480E+04	2.47651958E+02	4.16435257E+04
417	-9.67741935E-01	4.18900000E+04	4.18275274E+04	6.24725874E+01	4.16415734E+04
418	-9.55645161E-01	4.15230000E+04	4.18320043E+04	-3.09043846E+02	4.16396442E+04
419	-9.43548387E-01	4.2C940000E+04	4.18369188E+04	2.57081217E+02	4.16377381E+04
420	-9.31451613E-01	4.21930000E+04	4.18421755E+04	3.50824506E+02	4.16358550E+04
421	-9.19354839E-C1	4.18940000E+04	4.18478393E+04	4.61607386E+01	4.16339949E+04
422	-9.07258065E-01	4.1E510000E+04	4.18539376E+04	-2.93758647E+00	4.16321579E+04
423	-8.95161290E-01	4.16340000E+04	4.18605004E+04	-2.26500425E+02	4.16303439E+04
424	-8.83064516E-01	4.16690000E+04	4.18675604E+04	-1.98560446E+02	4.16285529E+04
425	-8.70967742E-01	4.15990000E+04	4.18751533E+04	-2.76153324E+02	4.16267850E+04
426	-8.58870968E-01	4.17820000E+04	4.18833181E+04	-1.01318071E+02	4.16250401E+04
427	-8.46774194E-01	4.16310000E+04	4.18920974E+04	-2.61097401E+02	4.16233193E+04
428	-8.34677419E-01	4.18090000E+04	4.19015382E+04	7.46184666E+00	4.16216195E+04
429	-8.22580645E-01	4.1E540000E+04	4.19116918E+04	-5.76917607E+01	4.16199437E+04
430	-8.10483871E-01	4.21700000E+04	4.19226148E+04	2.47385218E+02	4.16182910E+04
431	-7.98387057E-01	4.2C320000E+04	4.19343695E+04	9.76304961E+01	4.16166613E+04
432	-7.86290323E-01	4.22300000E+04	4.19470246E+04	2.82975372E+02	4.16150547E+04
433	-7.74193548E-01	4.22350000E+04	4.19606560E+04	2.74343957E+02	4.16134711E+04
434	-7.62096774E-01	4.19520000E+04	4.19753477E+04	-2.33477056E+01	4.16119105E+04
435	-7.50000000E-01	4.15910000E+04	4.19911926E+04	-4.00192643E+02	4.16103730E+04
436	-7.37903226E-01	4.21560000E+04	4.20082941E+04	1.477059C5E+02	4.16088586E+04
437	-7.258C6452E-C1	4.1E760000E+04	4.20267668E+04	-3.07668115E+01	4.16073671E+04
438	-7.13709677E-C1	4.2C140000E+04	4.20467385E+04	-3.27385342E+01	4.16058987E+04
439	-7.01612903E-01	4.21260000E+04	4.20683517E+04	5.76483132E+01	4.16044534E+04
440	-6.89516129E-01	4.1E790000E+04	4.20917653E+04	-2.12765300E+02	4.16030311E+04
441	-6.77419355E-01	4.14150000E+04	4.21171572E+04	-7.02157208E+02	4.16016318E+04
442	-6.65322581E-C1	4.21350000E+04	4.21447265E+04	4.02734534E+01	4.16002556E+04
443	-6.53225806E-01	4.16200000E+04	4.21746966E+04	-5.54646593E+02	4.15989024E+04
444	-6.41129C32E-01	4.21830000E+04	4.22073180E+04	-2.43179895E+01	4.15975722E+04
445	-6.29032258E-01	4.17340000E+04	4.22428724E+04	-5.08872377E+02	4.15962651E+04
446	-6.16535484E-01	4.20300000E+04	4.22816765E+04	-2.51676482E+02	4.15949811E+04
447	-6.04838710E-01	4.2C570000E+04	4.23240867E+04	-2.67086670E+02	4.15937200E+04
448	-5.92741935E-01	4.23290000E+04	4.23705040E+04	-4.15039673E+01	4.15924820E+04
449	-5.80645161E-01	4.1E760000E+04	4.24213795E+04	-5.45379518E+02	4.15912671E+04
450	-5.68548387E-01	4.22920000E+04	4.24772204E+04	-1.85220378E+02	4.15900752E+04
451	-5.56451613E-C1	4.25450000E+04	4.25385955E+04	6.40452551E+00	4.15889063E+04
452	-5.44354839E-01	4.27890000E+04	4.26061414E+04	1.82858594E+02	4.15877605E+04
453	-5.32258065E-01	4.26010000E+04	4.26805676E+04	-7.95675695E+01	4.15866377E+04
454	-5.20161290E-01	4.3C990000E+04	4.27626598E+04	3.26340218E+02	4.15855380E+04
455	-5.08064516E-01	4.29830000E+04	4.28532812E+04	1.29718838E+02	4.15844613E+04
456	-4.9567742E-01	4.31120000E+04	4.29533684E+04	1.58631621E+02	4.15834076E+04
457	-4.83870968E-01	4.29360000E+04	4.30639206E+04	-1.27920567E+02	4.15823770E+04
458	-4.71774194E-01	4.28310000E+04	4.31859770E+04	-3.54977016E+02	4.15813694E+04
459	-4.59677419E-01	4.32940000E+04	4.33205783E+04	-2.65783356E+01	4.15803848E+04
460	-4.47580645E-01	4.32750000E+04	4.34687040E+04	-1.93704007E+02	4.15794233E+04
461	-4.35483871E-01	4.38670000E+04	4.36311773E+04	2.35822657E+02	4.15784849E+04

462	-4.23387097E-01	4.4C030000E+04	4.38085276E+04	1.94472417E+02	4.15775694F+04
463	-4.11290323E-01	4.35660000E+04	4.40007985E+04	-3.47984974E+01	4.15766771E+04
464	-3.99193548E-01	4.46660000E+04	4.42072960E+04	4.58703955E+02	4.15758077E+04
465	-3.87096774E-01	4.48460000E+04	4.44262762E+04	4.19723802E+02	4.15749614E+04
466	-3.75000000E-01	4.46840000E+04	4.46545917E+04	2.94083339E+01	4.15741382E+04
467	-3.62903226E-01	4.50540000E+04	4.48873455E+04	1.66654546E+02	4.15733379E+04
468	-3.50806452E-01	4.53470000E+04	4.51176390E+04	2.79361005E+02	4.15725608E+04
469	-3.38709677E-01	4.52990000E+04	4.53365438E+04	-3.75438083E+01	4.15718066E+04
470	-3.26612903E-01	4.54950000E+04	4.55334461E+04	-3.84460802E+01	4.15710755E+04
471	-3.14516129E-01	4.54670000E+04	4.56968802E+04	-2.29880193E+02	4.15703675E+04
472	-3.02419355E-01	4.60270000E+04	4.58158518E+04	2.11148173E+02	4.15696824E+04
473	-2.90322581E-01	4.55870000E+04	4.58814618E+04	-2.94461829E+02	4.15690205E+04
474	-2.78225806E-01	4.56700000E+04	4.58884493E+04	-2.18449274E+02	4.15683815E+04
475	-2.66129032E-01	4.53510000E+04	4.58361933E+04	-4.85193280E+02	4.15677656E+04
476	-2.54032258E-01	4.52390000E+04	4.57288355E+04	-4.89835470E+02	4.15671728E+04
477	-2.41935484E-01	4.57000000E+04	4.55744799E+04	1.25520099E+02	4.15666029E+04
478	-2.29838710E-01	4.55470000E+04	4.53837454E+04	1.63254607E+02	4.15660562E+04
479	-2.17741935E-01	4.57880000E+04	4.51681200E+04	6.19880049E+02	4.15655324F+04
480	-2.05645161E-01	4.48000000E+04	4.49385346E+04	-1.38534572E+02	4.15650317E+04
481	-1.93548387E-01	4.45810000E+04	4.47043984E+04	2.76601650E+02	4.15645541E+04
482	-1.81451613E-01	4.43470000E+04	4.44731372E+04	-1.26137164E+02	4.15640995E+04
483	-1.69354839E-01	4.44000000E+04	4.42501410E+04	1.49859019E+02	4.15636679E+04
484	-1.57258065E-01	4.42280000E+04	4.40389724E+04	1.89027634E+02	4.15632593E+04
485	-1.45161290E-01	4.40930000E+04	4.38416989E+04	2.51301128E+02	4.15628735E+04
486	-1.33064516E-01	4.36920000E+04	4.36592506E+04	3.27494456E+01	4.15625114E+04
487	-1.20967742E-01	4.38240000E+04	4.34917454E+04	3.32254635E+02	4.15621720E+04
488	-1.08870968E-01	4.33810000E+04	4.33387574E+04	4.22426221E+01	4.15618556E+04
489	-9.67741935E-02	4.31290000E+04	4.31995232E+04	-7.05232254E+01	4.15615623E+04
490	-8.46774194E-02	4.29810000E+04	4.30730927E+04	-9.20927209E+01	4.15612920E+04
491	-7.25806452E-02	4.31380000E+04	4.29584338E+04	1.79566211E+02	4.15610447E+04
492	-6.04838710E-02	4.26230000E+04	4.28545023E+04	-2.31502310E+02	4.15608205E+04
493	-4.83870968E-02	4.27710000E+04	4.27602862E+04	1.07137637E+01	4.15606193E+04
494	-3.62903226E-02	4.25810000E+04	4.26748315E+04	-9.38315441E+01	4.15604412E+04
495	-2.41935484E-02	4.26460000E+04	4.25972558E+04	4.87442381E+01	4.15602861E+04
496	-1.20967742E-02	4.24550000E+04	4.25267533E+04	-7.17532920E+01	4.15601541E+04
497	0.	4.24050000E+04	4.24625955E+04	-5.75955074E+01	4.156000451E+04
498	1.20967742E-02	4.23710000E+04	4.24041277E+04	-3.31276856F+01	4.15599591E+04
499	2.41935484E-02	4.21210000E+04	4.23507642E+04	-2.29764174E+02	4.15598962E+04
500	3.62903226E-02	4.24840000E+04	4.23019827E+04	1.82017300E+02	4.15598563E+04
501	4.83870968E-02	4.21890000E+04	4.22573184E+04	-6.83184215E+01	4.15598394E+04
502	6.04838710E-02	4.21270000E+04	4.22163581E+04	-8.93580619E+01	4.15598456F+04
503	7.25806452E-02	4.19830000E+04	4.21787344E+04	-1.95734360E+02	4.15598748E+04
504	8.46774194E-02	4.20080000E+04	4.21441209E+04	-1.36120929E+02	4.15599271E+04
505	9.67741935E-02	4.20830000E+04	4.21122276E+04	-2.92275862E+01	4.15600024E+04
506	1.08870968E-01	4.18620000E+04	4.20827961E+04	-2.20796145E+02	4.15601008E+04
507	1.20967742E-01	4.22640000E+04	4.20555967E+04	2.08403329E+02	4.15602222E+04
508	1.33064516E-01	4.19210000E+04	4.20304242E+04	-1.09424154E+02	4.15603666F+04
509	1.45161290E-01	4.19730000E+04	4.20070956E+04	-3.40955770E+01	4.15605341E+04
510	1.57258065E-01	4.20630000E+04	4.19854473E+04	7.75526664E+01	4.15607246E+04
511	1.69354839E-01	4.20560000E+04	4.19653330E+04	9.06670428E+01	4.15609381E+04
512	1.81451613E-01	4.19920000E+04	4.19466211E+04	4.53788697E+01	4.15611747E+04
513	1.93548387E-01	4.15890000E+04	4.19291939E+04	-3.40193938E+02	4.15614344E+04
514	2.05645161E-01	4.16600000E+04	4.19129453E+04	-2.52945334E+02	4.15617171E+04
515	2.17741935E-01	4.15980000E+04	4.18977798E+04	-2.99779802E+02	4.15620228E+04
516	2.29838710E-01	4.19950000E+04	4.18836112E+04	1.11388829E+02	4.15623515E+04
517	2.41935484E-01	4.14940000E+04	4.18703616E+04	-3.76361583E+02	4.15627033E+04
518	2.54032258E-01	4.15960000E+04	4.18579606E+04	-2.61960581E+02	4.15630782E+04
519	2.66129032E-01	4.16600000E+04	4.18463443E+04	-1.86344311E+02	4.15634760E+04
520	2.78225806E-01	4.19400000E+04	4.18354548E+04	1.04545189E+02	4.15638970E+04
521	2.90322581E-01	4.15920000E+04	4.18252394E+04	-2.33239397E+02	4.15643409E+04
522	3.02419355E-01	4.17710000E+04	4.18156501E+04	-4.46501036E+01	4.15648079E+04
523	3.14516129E-01	4.15130000E+04	4.18066432E+04	-2.93643206E+02	4.15652979E+04
524	3.26612903E-01	4.16970000E+04	4.17981788E+04	-1.01178786E+02	4.15658110E+04
525	3.38709677E-01	4.18280000E+04	4.17902203E+04	3.77796510E+01	4.15663471E+04

526	3.50806452E-01	4.14570000E+04	4.17827345E+04	-3.25734490E+02	4.15669063E+04
527	3.62903226E-01	4.16240000E+04	4.1775906E+04	-1.51690586E+02	4.15674885E+04
528	3.75000000E-01	4.16590000E+04	4.17690605E+04	-1.10060534E+02	4.15680937E+04
529	3.87096774E-01	4.18010000E+04	4.17628185E+04	3.81814954E+01	4.15687220E+04
530	3.99193548E-01	4.18660000E+04	4.17569407E+04	1.09059265E+02	4.15693733E+04
531	4.11290323E-01	4.15300000E+04	4.17514053E+04	-2.21405332E+02	4.15700477E+04
532	4.23387097E-01	4.14150000E+04	4.17461921E+04	-3.31192105E+02	4.15707451E+04
533	4.35483871E-01	4.18180000E+04	4.17412824E+04	7.67175882E+01	4.15714656E+04
534	4.47580645E-01	4.17180000E+04	4.17366590E+04	-1.86590168E+01	4.15722090E+04
535	4.59677419E-01	4.18540000E+04	4.17323060E+04	1.21694028E+02	4.15729756E+04
536	4.71774194E-01	4.15510000E+04	4.17282085E+04	-1.77208501E+02	4.15737651E+04
537	4.83870968E-01	4.13980000E+04	4.17243529E+04	-3.26352904E+02	4.15745777E+04
538	4.95967742E-01	4.15660000E+04	4.17207265E+04	-1.54726459E+02	4.15754134E+04
539	5.08064516E-01	4.16110000E+04	4.17173173E+04	-1.06317348E+02	4.15762721E+04
540	5.20161290E-01	4.18230000E+04	4.17141146E+04	1.08885426E+02	4.15771538E+04
541	5.32258065E-01	4.14900000E+04	4.17111079E+04	-2.21107902E+02	4.15780585E+04
542	5.44354839E-01	4.16190000E+04	4.17082878E+04	-8.92877930E+01	4.15789863E+04
543	5.56451613E-01	4.14910000E+04	4.17056453E+04	-2.14645348E+02	4.15799372E+04
544	5.68548387E-01	4.18250000E+04	4.17031723E+04	1.21827740E+02	4.15809111E+04
545	5.80645161E-01	4.17260000E+04	4.17008608E+04	2.51392331E+01	4.15819080E+04
546	5.92741935E-01	4.18620000E+04	4.16987036E+04	1.63296390E+02	4.15829280E+04
547	6.04838710E-01	4.19370000E+04	4.16966940E+04	2.40306006E+02	4.15839710E+04
548	6.16935484E-01	4.22070000E+04	4.16948256E+04	5.12174445E+02	4.15850370E+04
549	6.29032258E-01	4.20770000E+04	4.16930923E+04	3.83907673E+02	4.15861261E+04
550	6.41129032E-01	4.13270000E+04	4.16914887E+04	-3.64488712E+02	4.15872382E+04
551	6.5325806E-01	4.17640000E+04	4.16900095E+04	7.39905463E+01	4.15883734E+04
552	6.65322581E-01	4.16590000E+04	4.16886496E+04	-2.96496141E+01	4.15895316E+04
553	6.77419355E-01	4.20540000E+04	4.16874045E+04	3.66595450E+02	4.15907129E+04
554	6.89516129E-01	4.16930000E+04	4.16862699E+04	6.73010879E+00	4.15919172E+04
555	7.01612903E-01	4.14590000E+04	4.16852415E+04	-2.26241524E+02	4.15931445E+04
556	7.13709677E-01	4.16350000E+04	4.16843156E+04	-4.93155726E+01	4.15943949E+04
557	7.25806452E-01	4.20400000E+04	4.16834884E+04	3.56511619E+02	4.15956683E+04
558	7.37903226E-01	4.19180000E+04	4.16827565E+04	2.35243500E+02	4.15969647E+04
559	7.50000000E-01	4.15210000E+04	4.16821167E+04	-1.61116675E+02	4.15982842E+04
560	7.62096774E-01	4.17570000E+04	4.16815658E+04	7.54341709E+01	4.15996267E+04
561	7.74193548E-01	4.19280000E+04	4.16811011E+04	2.46898944E+02	4.16009923E+04
562	7.86290323E-01	4.18090000E+04	4.16807196E+04	1.28280395E+02	4.16023809E+04
563	7.98387097E-01	4.15260000E+04	4.16804189E+04	-1.54418873E+02	4.16037926E+04
564	8.10483871E-01	4.15770000E+04	4.16801964E+04	-1.03196397E+02	4.16052273E+04
565	8.22580645E-01	4.16480000E+04	4.16800498E+04	-3.20498420E+01	4.16066850E+04
566	8.34677419E-01	4.11770000E+04	4.16799770E+04	-5.02976993E+02	4.16081658E+04
567	8.46774194E-01	4.20200000E+04	4.16799758E+04	3.40024248E+02	4.16096656E+04
568	8.58870968E-01	4.16190000E+04	4.16800441E+04	-6.10441258E+01	4.16111965E+04
569	8.70967742E-01	4.17150000E+04	4.16801802E+04	3.48197777E+01	4.16127463E+04
570	8.83064516E-01	4.22250000E+04	4.16803822E+04	5.44617756E+02	4.16143193E+04
571	8.95161290E-01	4.15520000E+04	4.16806485E+04	-1.28648483E+02	4.16159153E+04
572	9.07258065E-01	4.15230000E+04	4.16809773E+04	-1.57977315E+02	4.16175343E+04
573	9.19354839E-01	4.19400000E+04	4.16813672E+04	2.586328C6E+02	4.16191763E+04
574	9.31451613E-01	4.15590000E+04	4.16818166E+04	2.77183351E+02	4.16208414E+04
575	9.43548387E-01	4.18010000E+04	4.16823243E+04	1.18675722E+02	4.16225296E+04
576	9.55645161E-01	4.17240000E+04	4.16828887E+04	4.11112521E+01	4.16242407E+04
577	9.67741935E-01	4.14020000E+04	4.16835088E+04	-2.81508785E+02	4.16259750E+04
578	9.79838710E-01	4.19370000E+04	4.16841832E+04	2.52816823E+02	4.16277322E+04
579	9.91935484E-01	4.14900000E+04	4.16849108E+04	-1.94910765E+02	4.16295125E+04
580	1.00403226E+00	4.15640000E+04	4.16856904E+04	-1.21690445E+02	4.16313159E+04
581	1.01612903E+00	4.14230000E+04	4.16865212E+04	-2.63521163E+02	4.16331422E+04
582	1.02822581E+00	4.17520000E+04	4.16874019E+04	6.45808050E+01	4.16349917E+04
583	1.04032258E+00	4.19320000E+04	4.16883317E+04	2.43668274E+02	4.16368641E+04
584	1.05241935E+00	4.17940000E+04	4.16893097E+04	1.04690313E+02	4.16387596E+04
585	1.06451613E+00	4.13630000E+04	4.16903349E+04	-2.27334914E+02	4.16406782E+04
586	1.07661290E+00	4.14450000E+04	4.16914066E+04	-2.46406565E+02	4.16426157E+04
587	1.08870968E+00	4.19110000E+04	4.16925238E+04	2.18476165E+02	4.16445844E+04
588	1.10080645E+00	4.15610000E+04	4.16936860E+04	2.67314050E+02	4.16465720E+04

589	1.11290323E+00	4.19270000E+04	4.16940922E+04	2.32107827E+02	4.16485827E+04
590	1.12500000E+00	4.15050000E+04	4.16961418E+04	-1.91141794E+02	4.16506165E+04
591	1.13709677E+00	4.16020000E+04	4.16974341E+04	-9.54341361E+01	4.16526732E+04
592	1.14919355E+00	4.16790000E+04	4.16987685E+04	-2.07685470E+01	4.16547531E+04
593	1.16129032E+00	4.17110000E+04	4.17001444E+04	1.08555971E+01	4.16568559E+04
594	1.17338710E+00	4.16000000E+04	4.17015611E+04	-1.01561105E+02	4.16589818E+04
595	1.18548387E+00	4.15650000E+04	4.17030131E+04	-1.38018078E+02	4.16611308E+04
596	1.19758656E+00	4.15240000E+04	4.17045148E+04	-1.80514770E+02	4.16633028E+04
597	1.20967742E+00	4.15270000E+04	4.17060507E+04	-1.79050652E+02	4.16654978E+04
598	1.22177419E+00	4.18350000E+04	4.17076252E+04	1.27374786E+02	4.16677159E+04
599	1.23387097E+00	4.17280000E+04	4.17092380E+04	1.87620342E+01	4.16699570E+04
600	1.24596774E+00	4.18970000E+04	4.17108884E+04	1.86111562E+02	4.16722211E+04
601	1.25864522E+00	4.17290000E+04	4.17125762E+04	1.64238220E+01	4.16745083E+04
602	1.27016129E+00	4.14880000E+04	4.17143008E+04	-2.26300751E+02	4.16768185E+04
603	1.28225806E+00	4.16140000E+04	4.17160617E+04	-1.02061737E+02	4.16791518E+04
604	1.29435484E+00	4.18830000E+04	4.17178587E+04	1.65141266E+02	4.16815081E+04
605	1.30645161E+00	4.15420000E+04	4.17196914E+04	2.22308645E+02	4.16838874E+04
606	1.31854839E+00	4.14800000E+04	4.17215592E+04	-2.41559224E+02	4.16862898E+04
607	1.33064516E+00	4.17200000E+04	4.17234620E+04	-3.46198359E+00	4.16887153E+04
608	1.34274194E+00	4.15030000E+04	4.17253993E+04	-2.22399286E+02	4.16911637E+04
609	1.35483871E+00	4.17590000E+04	4.17273708E+04	3.16292036E+01	4.16936352E+04
610	1.36693548E+00	4.14980000E+04	4.17293762E+04	-2.31376194E+02	4.16961298E+04
611	1.37903226E+00	4.15700000E+04	4.17314152E+04	-1.61415167E+02	4.16986474E+04
612	1.39112903E+00	4.18070000E+04	4.17334874E+04	7.35125843E+01	4.17011880E+04
613	1.40322581E+00	4.19730000E+04	4.17355927E+04	2.37407348E+02	4.17037517E+04
614	1.41532258E+00	4.14150000E+04	4.17377306E+04	-3.22730596E+02	4.17063384E+04
615	1.42741935E+00	4.15980000E+04	4.17399010E+04	-1.41900980E+02	4.17089481E+04
616	1.43951613E+00	4.19190000E+04	4.17421035E+04	1.76896459E+02	4.17115809E+04
617	1.45161290E+00	4.16240000E+04	4.17443380E+04	-1.20338031E+02	4.17142368E+04
618	1.46370568E+00	4.21490000E+04	4.17466042E+04	4.02395754E+02	4.17169156E+04
619	1.47580645E+00	4.18250000E+04	4.17489018E+04	7.60981683E+01	4.17196175E+04
620	1.48790323E+00	4.16510000E+04	4.17512307E+04	-1.00230682E+02	4.17223425E+04
621	1.50000000E+00	4.20630000E+04	4.17535905E+04	3.09409463E+02	4.17250905E+04
622	1.51209677E+00	4.16680000E+04	4.17559812E+04	-8.79811864E+01	4.17278615E+04
623	1.52419355E+00	4.15880000E+04	4.17584024E+04	2.29597575E+02	4.17306556E+04
624	1.53629032E+00	4.15770000E+04	4.17608541E+04	-1.83854054E+02	4.17334727E+04
625	1.54838710E+00	4.17370000E+04	4.17633359E+04	-2.63358826E+01	4.17363129E+04
626	1.56048387E+00	4.17530000E+04	4.17658477E+04	-1.28477254E+01	4.17391761E+04
627	1.57258065E+00	4.17640000E+04	4.17683894E+04	-4.38940289E+00	4.17420623E+04
628	1.58467742E+00	4.18340000E+04	4.17709607E+04	6.30392587E+01	4.17449716E+04
629	1.59677419E+00	4.19390000E+04	4.17735616E+04	1.65438427E+02	4.17479039E+04
630	1.60887097E+00	4.16960000E+04	4.17761917E+04	-8.01917336E+01	4.17508552E+04
631	1.62096774E+00	4.16470000E+04	4.17788511E+04	-1.31851067E+02	4.17538376E+04
632	1.63306452E+00	4.17700000E+04	4.17815394E+04	-1.15394190E+01	4.17568391E+04
633	1.64516129E+00	4.17380000E+04	4.17842566E+04	-4.62566422E+01	4.17598636E+04
634	1.65725806E+00	4.19010000E+04	4.17870026E+04	1.12597407E+02	4.17629111E+04
635	1.66935484E+00	4.18950000E+04	4.17897771E+04	1.05222868E+02	4.17659816E+04
636	1.68145161E+00	4.21630000E+04	4.17925801E+04	3.70419877E+02	4.17690752E+04
637	1.69354839E+00	4.18520000E+04	4.17954114E+04	5.65885625E+01	4.17721919E+04
638	1.70564516E+00	4.21170000E+04	4.17982709E+04	3.18729053E+02	4.17753316E+04
639	1.71774194E+00	4.18530000E+04	4.18011585E+04	5.18414720E+01	4.17784943E+04
640	1.72983871E+00	4.19830000E+04	4.18040741E+04	1.78925938E+02	4.17816800E+04
641	1.74193548E+00	4.18210000E+04	4.18070174E+04	1.39825683E+01	4.17848888E+04
642	1.75403226E+00	4.14530000E+04	4.18099885E+04	-3.56988525E+02	4.17881207E+04
643	1.76612903E+00	4.20690000E+04	4.18129872E+04	2.56012766E+02	4.17913756E+04
644	1.77822581E+00	4.18750000E+04	4.18160135E+04	5.89865499E+01	4.17946535E+04
645	1.79032258E+00	4.16830000E+04	4.18190671E+04	-1.36067072E+02	4.17979544E+04
646	1.80241935E+00	4.20320000E+04	4.18221480E+04	2.09852002E+02	4.18012784E+04
647	1.81451613E+00	4.22290000E+04	4.18252561E+04	4.03743868E+02	4.18046255E+04
648	1.82661290E+00	4.19810000E+04	4.18283914E+04	1.52608621E+02	4.18079956E+04
649	1.83870568E+00	4.19530000E+04	4.18315536E+04	1.21446353E+02	4.18113887E+04
650	1.85080645E+00	4.20340000E+04	4.18347428E+04	1.99257153E+02	4.18148049E+04
651	1.86290323E+00	4.17530000E+04	4.18379589E+04	-8.45588920E+01	4.18182441E+04
652	1.87500000E+00	4.17080000E+04	4.18412017E+04	-1.33201697E+02	4.18217063E+04

653	1.88709677E+00	4.16680000E+04	4.18444712E+04	-1.76471181E+02	4.18251916E+04
654	1.89919355E+00	4.20480000E+04	4.18477673E+04	2.00232736E+02	4.18286999E+04
655	1.91129032E+00	4.20290000E+04	4.18510899E+04	1.77910133E+02	4.18322313E+04
656	1.92338710E+00	4.13980000E+04	4.18544389E+04	-4.56438915E+02	4.18357857E+04
657	1.93548387E+00	4.18760000E+04	4.18578143E+04	1.81856644E+01	4.18393631E+04
658	1.94758065E+00	4.18490000E+04	4.18612161E+04	-1.22160561E+01	4.18429636E+04
659	1.95967742E+00	4.18760000E+04	4.18646440E+04	1.13559930E+01	4.18465871E+04
660	1.97177419E+00	4.19310000E+04	4.18680981E+04	6.29018793E+01	4.18502337E+04
661	1.98387097E+00	4.22370000E+04	4.18715783E+04	3.65421669E+02	4.18539033E+04
662	1.99596774E+00	4.15470000E+04	4.18750846E+04	-3.28084574E+02	4.18575960E+04
663	2.00806452E+00	4.17700000E+04	4.18786168E+04	-1.08616786E+02	4.18613117E+04
664	2.02016129E+00	4.21720000E+04	4.18821749E+04	2.89825092E+02	4.18650504E+04
665	2.03225E06E+00	4.17370000E+04	4.18857589E+04	-1.48758878E+02	4.18688122E+04
666	2.04435484E+00	4.17980000E+04	4.18893686E+04	-9.13686408E+01	4.18725970E+04
667	2.05645161E+00	4.20600000E+04	4.18930041E+04	1.66995862E+02	4.18764048E+04
668	2.06854839E+00	4.19250000E+04	4.18966653E+04	2.83346843E+01	4.18802357E+04
669	2.08064516E+00	4.22470000E+04	4.19003521E+04	3.46647880E+02	4.18840896E+04
670	2.09274194E+00	4.16800000E+04	4.19040645E+04	-2.24064498E+02	4.18879666E+04
671	2.10483871E+00	4.18000000E+04	4.19078024E+04	-1.07802400E+02	4.18918666E+04
672	2.11693548E+00	4.19130000E+04	4.19115658E+04	1.43422368E+00	4.18957897E+04
673	2.12903226E+00	4.20140000E+04	4.19153546E+04	9.86454224E+01	4.18997358E+04
674	2.14112903E+00	4.21160000E+04	4.19191688E+04	1.96831243E+02	4.19037049E+04
675	2.15322581E+00	4.20460000E+04	4.19230083E+04	1.22991731E+02	4.19076971E+04
676	2.16532258E+00	4.20770000E+04	4.19268731E+04	1.50126932E+02	4.19117123E+04
677	2.17741935E+00	4.17000000E+04	4.19307631E+04	-2.30763110E+02	4.19157505E+04
678	2.18951613E+00	4.16870000E+04	4.19346784E+04	-2.47678353E+02	4.19198118E+04
679	2.20161290E+00	4.21610000E+04	4.19386188E+04	2.22381245E+02	4.19238962E+04
680	2.21370968E+00	4.17410000E+04	4.19425843E+04	-2.01584275E+02	4.19280035E+04
681	2.22580645E+00	4.18280000E+04	4.19465749E+04	-1.18574874E+02	4.19321339E+04
682	2.23790323E+00	4.19710000E+04	4.19505905E+04	2.04094883E+01	4.19362874E+04
683	2.25000000E+00	4.20500000E+04	4.19546312E+04	9.53688484E+01	4.19404639E+04
684	2.26209677E+00	4.20430000E+04	4.19586968E+04	8.43032438E+01	4.19446634E+04
685	2.27419355E+00	4.20130000E+04	4.19627873E+04	5.02127106E+01	4.19488860E+04
686	2.28629032E+00	4.20000000E+04	4.19669027E+04	3.30972841E+01	4.19531316E+04
687	2.29838710E+00	4.16760000E+04	4.19710430E+04	-2.95043001E+02	4.19574003E+04
688	2.31048387E+00	4.15820000E+04	4.19752081E+04	6.79188834E+00	4.19616920E+04
689	2.32258065E+00	4.20350000E+04	4.19793980E+04	5.56019856E+01	4.19660067E+04
690	2.33467742E+00	4.21150000E+04	4.19836127E+04	1.31387323E+02	4.19703445E+04
691	2.34677419E+00	4.20530000E+04	4.19878521E+04	6.51479313E+01	4.19747053E+04
692	2.35887097E+00	4.19630000E+04	4.19921162E+04	-2.91161582E+01	4.19790852E+04
693	2.37096774E+00	4.20810000E+04	4.19964049E+04	8.45950843E+01	4.19834961E+04
694	2.38306452E+00	4.18130000E+04	4.20007183E+04	-1.87718312E+02	4.19879260E+04
695	2.39516129E+00	4.16500000E+04	4.20050563E+04	-3.55056318E+02	4.19923790E+04
696	2.40725806E+00	4.17150000E+04	4.20094189E+04	-2.94418906E+02	4.19968550E+04
697	2.41935484E+00	4.20660000E+04	4.20138060E+04	5.21939513E+01	4.20013541E+04
698	2.43145161E+00	4.20000000E+04	4.20182177E+04	-1.82177160E+01	4.20058762E+04
699	2.44354839E+00	4.20000000E+04	4.20226539E+04	-2.26538909E+01	4.20104213E+04
700	2.45564516E+00	4.20860000E+04	4.20271145E+04	5.88854614E+01	4.20149895E+04
701	2.46774194E+00	4.19630000E+04	4.20315996E+04	-6.85996372E+01	4.20195807E+04
702	2.47983871E+00	4.20000000E+04	4.20361092E+04	-3.61091620E+01	4.20241950E+04
703	2.49193548E+00	4.23960000E+04	4.20406431E+04	3.55356911E+02	4.20288323E+04
704	2.50403226E+00	4.20270000E+04	4.20452014E+04	-1.82013949E+01	4.20334926E+04
705	2.51612903E+00	4.15630000E+04	4.20497841E+04	-8.67840565E+01	4.20381760E+04
706	2.52822581E+00	4.20610000E+04	4.20543911E+04	6.60894856E+00	4.20428824E+04
707	2.54032258E+00	4.21570000E+04	4.20590224E+04	9.79776424E+01	4.20476119E+04
708	2.55241935E+00	4.19630000E+04	4.20636780E+04	-1.00677954E+02	4.20523644E+04
709	2.56451613E+00	4.19230000E+04	4.20683578E+04	-1.45357818E+02	4.20571399E+04
710	2.57661290E+00	4.22900000E+04	4.20730619E+04	2.16938069E+02	4.20619385E+04
711	2.58870968E+00	4.18840000E+04	4.20777903E+04	-1.93790271E+02	4.20667602E+04
712	2.60080645E+00	4.21910000E+04	4.20825428E+04	1.08457181E+02	4.20716048E+04
713	2.61290323E+00	4.23340000E+04	4.20873196E+04	2.46680444E+02	4.20764725E+04
714	2.62500000E+00	4.22350000E+04	4.20921205E+04	1.42879538E+02	4.20813633E+04
715	2.63709677E+00	4.20430000E+04	4.20969455E+04	-5.39455196E+01	4.20862771E+04
716	2.64919355E+00	4.21760000E+04	4.21017947E+04	7.42052903E+01	4.20912139E+04

717	2.66129032E+00	4.22570000E+04	4.21066680E+04	1.50331985E+02	4.20961738E+04
718	2.67338710E+00	4.18990000E+04	4.21115654E+04	-2.12565417E+02	4.21011567E+04
719	2.68548387E+00	4.18390000E+04	4.21164869E+04	-2.77486900E+02	4.21061626E+04
720	2.69758065E+00	4.21310000E+04	4.21214324E+04	9.56755365E+00	4.21111916E+04
721	2.70967742E+00	4.20560000E+04	4.21264020E+04	-7.04020398E+01	4.21162436E+04
722	2.72177419E+00	4.23350000E+04	4.21313957E+04	2.03604336E+02	4.21213187E+04
723	2.73387097E+00	4.21400000E+04	4.21364133E+04	3.58669633E+00	4.21264168E+04
724	2.74596774E+00	4.21140000E+04	4.21414549E+04	-2.74549429E+01	4.21315380E+04
725	2.75806452E+00	4.20390000E+04	4.21465206E+04	-1.07520567E+02	4.21366821E+04
726	2.77016129E+00	4.20280000E+04	4.21516102E+04	-1.23610160E+02	4.21418494E+04
727	2.78225806E+00	4.22340000E+04	4.21567237E+04	7.72762916E+01	4.21470396E+04
728	2.79435484E+00	4.19140000E+04	4.21618612E+04	-2.47861158E+02	4.21522530E+04
729	2.80645161E+00	4.18800000E+04	4.21670226E+04	-2.87022613E+02	4.21574893E+04
730	2.81854839E+00	4.20210000E+04	4.21722079E+04	-1.51207942E+02	4.21627487E+04
731	2.83064516E+00	4.23070000E+04	4.21774172E+04	1.29582829E+02	4.21680311E+04
732	2.84274194E+00	4.21520000E+04	4.21826503E+04	-3.06502851E+01	4.21733366E+04
733	2.85483871E+00	4.15820000E+04	4.21879073E+04	-2.05907273E+02	4.21786651E+04
734	2.86693548E+00	4.21300000E+04	4.21931881E+04	-6.31881214E+01	4.21840167E+04
735	2.87903226E+00	4.24150000E+04	4.21984928E+04	2.16507182E+02	4.21893913E+04
736	2.89112903E+00	4.21730000E+04	4.22038214E+04	-3.08213501E+01	4.21947889E+04
737	2.90322581E+00	4.18510000E+04	4.22091737E+04	-3.58173706E+02	4.22002096E+04
738	2.91532258E+00	4.23030000E+04	4.22145499E+04	8.84501257E+01	4.22056533E+04
739	2.92741935E+00	4.22270000E+04	4.22199498E+04	7.05015711E+00	4.22111200E+04
740	2.93951613E+00	4.23910000E+04	4.22253736E+04	1.65626399E+02	4.22166098E+04
741	2.95161290E+00	4.17400000E+04	4.22308211E+04	-4.90821136E+02	4.22221227E+04
742	2.96370968E+00	4.22530000E+04	4.22362924E+04	1.67075613E+01	4.22276586E+04
743	2.97580645E+00	4.24380000E+04	4.22417875E+04	1.96212502E+02	4.22332175E+04
744	2.98790323E+00	4.20680000E+04	4.22473063E+04	-1.79306302E+02	4.22387994E+04
745	3.00000000E+00	4.23910000E+04	4.22528488E+04	1.38151158E+02	4.22444044E+04
746	3.01209677E+00	4.20540000E+04	4.22584151E+04	-2.04415108E+02	4.22500325E+04
747	3.02419355E+00	4.21810000E+04	4.22640051E+04	-8.30050881E+01	4.22556835E+04
748	3.03629032E+00	4.25570000E+04	4.22696188E+04	2.87981226E+02	4.22613577E+04
749	3.04838710E+00	4.21910000E+04	4.22752562E+04	-8.42561560E+01	4.22670548E+04
750	3.06048387E+00	4.22830000E+04	4.22809172E+04	2.08277571E+00	4.22727750E+04
751	3.07258065E+00	4.22490000E+04	4.22866020E+04	-3.76019698E+01	4.22785183E+04
752	3.08467742E+00	4.24940000E+04	4.22923104E+04	2.01689617E+02	4.22842845E+04
753	3.09677419E+00	4.20140000E+04	4.22980425E+04	-2.84042456E+02	4.22900739E+04
754	3.10887097E+00	4.28490000E+04	4.23037982E+04	5.45201821E+02	4.22958862E+04
755	3.12096774E+00	4.20390000E+04	4.23095775E+04	-2.70577543E+02	4.23017216E+04
756	3.13306452E+00	4.24070000E+04	4.23153805E+04	9.16194587E+01	4.23075801E+04
757	3.14516129E+00	4.25080000E+04	4.23212072E+04	1.86792836E+02	4.23134615E+04
758	3.15725806E+00	4.24900000E+04	4.23270574E+04	1.62942597E+02	4.23193661E+04
759	3.16935484E+00	4.25550000E+04	4.23329313E+04	2.22068748E+02	4.23252936E+04
760	3.18145161E+00	4.22050000E+04	4.23388287E+04	-1.33828700E+02	4.23312442E+04
761	3.19354839E+00	4.23740000E+04	4.23447497E+04	2.92502577E+01	4.23372179E+04
762	3.20564516E+00	4.21710000E+04	4.23506944E+04	-1.79694370E+02	4.23432146E+04
763	3.21774194E+00	4.23980000E+04	4.23566626E+04	4.13374254E+01	4.23492343E+04
764	3.22983871E+00	4.22170000E+04	4.23626544E+04	-1.45654350E+02	4.23552770E+04
765	3.24193548E+00	4.25670000E+04	4.23686697E+04	1.98330311E+02	4.23613429E+04
766	3.25403226E+00	4.25300000E+04	4.23747086E+04	1.55291416E+02	4.23674317E+04
767	3.26612903E+00	4.22410000E+04	4.23807710E+04	-1.39771028E+02	4.23735436E+04
768	3.27822581E+00	4.20210000E+04	4.23868570E+04	-3.65857014E+02	4.23796785E+04
769	3.29032258E+00	4.24880000E+04	4.23929665E+04	9.50334637E+01	4.23858365E+04
770	3.30241935E+00	4.25500000E+04	4.23990996E+04	1.50900413E+02	4.23920175E+04
771	3.31451613E+00	4.22420000E+04	4.24052562E+04	-1.63256160E+02	4.23982215E+04
772	3.32661290E+00	4.24800000E+04	4.24114362E+04	6.85637513E+01	4.24044486E+04
773	3.33870968E+00	4.22060000E+04	4.24176398E+04	-2.11639847E+02	4.24106987E+04
774	3.35080645E+00	4.25460000E+04	4.24238669E+04	1.22133051E+02	4.24169719E+04
775	3.36290323E+00	4.23250000E+04	4.24301175E+04	-1.05117548E+02	4.24232681E+04
776	3.37500000E+00	4.21170000E+04	4.24363916E+04	-3.19391638E+02	4.24295874E+04
777	3.38709677E+00	4.25270000E+04	4.24426892E+04	8.43107872E+01	4.24359297E+04
778	3.39919355E+00	4.22140000E+04	4.24490103E+04	-2.35010267E+02	4.24422950E+04
779	3.41129032E+00	4.27590000E+04	4.24553548E+04	3.02645204E+02	4.24486834E+04
780	3.42338710E+00	4.21570000E+04	4.24617228E+04	-3.04722792E+02	4.24550948E+04

781	3.43548387E+0C	4.23030000E+04	4.24681143E+04	-1.65114251E+02	4.24615292E+04
782	3.44758065E+0C	4.24120000E+04	4.24745292E+04	-6.25291673E+01	4.24679867E+04
783	3.45967742E+0C	4.26000000E+04	4.24809675E+04	1.19032465E+02	4.24744672E+04
784	3.47177419E+0C	4.25910000E+04	4.24874293E+04	5.03570651E+02	4.24809708E+04
785	3.48387097E+0C	4.24190000E+04	4.24939146E+04	-7.49146047E+01	4.24874974E+04
786	3.49596774E+0C	4.19760000E+04	4.25004233E+04	-5.24423296E+02	4.24940471E+04
787	3.50806452E+0C	4.22080000E+04	4.25069554E+04	-2.98955419E+02	4.25006198E+04
788	3.52016129E+0C	4.29440000E+04	4.25135110E+04	4.30489032E+02	4.25072155E+04
789	3.53225806E+0C	4.24650000E+04	4.25200899E+04	-5.50899377E+01	4.25138343E+04
790	3.54435484E+0C	4.26650000E+04	4.25266923E+04	1.38307676E+02	4.25204761E+04
791	3.55645161E+0C	4.26180000E+04	4.25333181E+04	8.46818775E+01	4.25271409E+04
792	3.56854839E+0C	4.23840000E+04	4.25399673E+04	-1.55967328E+02	4.25338288E+04
793	3.58064516E+0C	4.25370000E+04	4.25466399E+04	-9.63993574E+00	4.25405398E+04
794	3.59274194E+0C	4.25880000E+04	4.25533359E+04	3.46640584E+01	4.25472737E+04
795	3.60483871E+0C	4.25160000E+04	4.25600553E+04	-4.40553411E+01	4.25540308E+04
796	3.61693548E+0C	4.28040000E+04	4.25667981E+04	2.37201870E+02	4.25608108E+04
797	3.62903226E+0C	4.25570000E+04	4.25735643E+04	-1.65643035E+01	4.25676139E+04
798	3.64112903E+0C	4.24180000E+04	4.25803539E+04	-1.62353858E+02	4.25744400E+04
799	3.65322581E+0C	4.23080000E+04	4.25871668E+04	-2.79166789E+02	4.25812892E+04
800	3.66532258E+0C	4.27190000E+04	4.25940031E+04	1.24996908E+02	4.25881614E+04
801	3.67741935E+CC	4.22410000E+04	4.26008628E+04	-3.59862763E+02	4.25950567E+04
802	3.68951613E+0C	4.28050000E+04	4.26077458E+04	1.97254201E+02	4.26019750E+04
803	3.70161290E+0C	4.26730000E+04	4.26146522E+04	6.33478041E+01	4.26089163E+04
804	3.71370968E+0C	4.26340000E+04	4.26215819E+04	1.24180510E+01	4.26158807E+04
805	3.72580645E+0C	4.25110000E+04	4.26285351E+04	-1.17535055E+02	4.26228681E+04
806	3.73790323E+0C	4.29440000E+04	4.26355115E+04	3.08488490E+02	4.26298786E+04
807	3.75000000E+0C	4.25270000E+04	4.26425113E+04	-1.15511310E+02	4.26369121E+04
808	3.76209677E+CC	4.29240000E+04	4.26495345E+04	2.74465548E+02	4.26439686E+04
809	3.77419355E+0C	4.26440000E+04	4.26565809E+04	-1.25809325E+01	4.26510482E+04
810	3.78629032E+0C	4.26000000E+04	4.26636507E+04	-6.36507473E+01	4.26581508E+04
811	3.79838710E+0C	4.23020000E+04	4.26707439E+04	-3.68743893E+02	4.26652765E+04
812	3.81048387E+0C	4.27600000E+04	4.26778604E+04	8.21356330E+01	4.26724252E+04
813	3.82258065E+0C	4.25400000E+04	4.26850002E+04	2.54999835E+02	4.26795969E+04
814	3.83467742E+0C	4.26530000E+04	4.26921633E+04	-3.91632842E+01	4.26867917E+04
815	3.84677419E+0C	4.28160000E+04	4.26993497E+04	1.16650279E+02	4.26940095E+04
816	3.85887097E+0C	4.27420000E+04	4.27065595E+04	3.54405276E+01	4.27012504E+04
817	3.87096774E+0C	4.27650000E+04	4.27137925E+04	5.12074650E+01	4.27085143E+04
818	3.88306452E+0C	4.25740000E+04	4.27210489E+04	-1.47048906E+02	4.27158012E+04
819	3.89516129E+0C	4.27550000E+04	4.27283286E+04	2.66714181E+01	4.27231112E+04
820	3.90725806E+0C	4.32210000E+04	4.27356316E+04	4.85368440E+02	4.27304443E+04
821	3.91935484E+CC	4.26280000E+04	4.27429578E+04	-1.14957837E+02	4.27378003E+04
822	3.93145161E+0C	4.26640000E+04	4.27503074E+04	-8.63074102E+01	4.27451794E+04
823	3.94354839E+CC	4.27730000E+04	4.27576803E+04	1.53197234E+01	4.27525816E+04
824	3.95564516E+0C	4.29460000E+04	4.27650764E+04	1.80923567E+02	4.27600068E+04
825	3.96774194E+0C	4.30170000E+04	4.27724959E+04	2.44504123E+02	4.27674550E+04
826	3.97983871E+0C	4.26690000E+04	4.27799386E+04	-1.10938606E+02	4.27749262E+04
827	3.99193548E+0C	4.26470000E+04	4.27874046E+04	-1.40404617E+02	4.27824206E+04
828	4.00403226E+0C	4.24300000E+04	4.27948939E+04	-3.648939C7E+02	4.27899379E+04
829	4.01612903E+0C	4.28220000E+04	4.28024065E+04	1.95935268E+01	4.27974783E+04
830	4.02822581E+0C	4.26950000E+04	4.28099423E+04	-1.14942314E+02	4.28050417E+04
831	4.04032258E+0C	4.30270000E+04	4.28175014E+04	2.09498575E+02	4.28126282E+04
832	4.05241935E+0C	4.28100000E+04	4.28250838E+04	-1.50838054E+01	4.28202377E+04
833	4.06451613E+CC	4.27230000E+04	4.28326895E+04	-1.09689452E+02	4.28278702E+04
834	4.07661290E+0C	4.26390000E+04	4.28403184E+04	-2.01318362E+02	4.28355259E+04
835	4.08870968E+0C	4.33530000E+04	4.28479705E+04	5.05029467E+02	4.28432045E+04
836	4.10080645E+0C	4.30160000E+04	4.28556460E+04	1.60354037E+02	4.28509061E+04
837	4.11290323E+0C	4.30430000E+04	4.28633446E+04	1.79655350E+02	4.28586308E+04
838	4.12500000E+0C	4.29110000E+04	4.28710666E+04	3.99334058E+01	4.28663786E+04
839	4.13709677E+0C	4.24450000E+04	4.28788118E+04	-4.33811782E+02	4.28741494E+04
840	4.14919355E+0C	4.25830000E+04	4.28865802E+04	9.64197761E+01	4.28819432E+04
841	4.16129032E+0C	4.27420000E+04	4.28943719E+04	-1.52371913E+02	4.28897601E+04
842	4.17338710E+0C	4.28890000E+04	4.29021868E+04	-1.31868461E+01	4.28976000E+04
843	4.18548387E+0C	4.30980000E+04	4.29100250E+04	1.87974978E+02	4.29054629E+04
844	4.19758065E+0C	4.32840000E+04	4.29178864E+04	3.66113561E+02	4.29133489E+04

845	4.20967742E+00	4.28110000E+04	4.29257711E+04	-1.14771094E+02	4.29212580E+04
846	4.22177419E+00	4.28660000E+04	4.29336790E+04	-6.76789852E+01	4.29291900E+04
847	4.23387097E+00	4.27110000E+04	4.29416101E+04	-2.30610111E+02	4.29371452E+04
848	4.24596774E+00	4.32990000E+04	4.29495645E+04	3.49435532E+02	4.29451233E+04
849	4.25806452E+00	4.30310000E+04	4.29575421E+04	7.34579445E+01	4.29531245E+04
850	4.27016129E+00	4.28560000E+04	4.29655429E+04	-1.09542871E+02	4.29611487E+04
851	4.28225806E+00	4.30130000E+04	4.29735669E+04	3.94330875E+01	4.29691960E+04
852	4.29435484E+00	4.28060000E+04	4.29816142E+04	-1.75614178E+02	4.29772663E+04
853	4.30645161E+00	4.31290000E+04	4.29896847E+04	1.39315334E+02	4.29853597E+04
854	4.31854839E+00	4.28720000E+04	4.29977784E+04	-1.25777837E+02	4.29934761E+04
855	4.33064516E+00	4.26260000E+04	4.30058953E+04	-3.79895300E+02	4.30016155E+04
856	4.34274194E+00	4.30790000E+04	4.30140354E+04	6.49645570E+01	4.30097780E+04
857	4.35483871E+00	4.31270000E+04	4.30221988E+04	1.04801199E+02	4.30179635E+04
858	4.36693548E+00	4.30620000E+04	4.30303854E+04	3.16146281E+01	4.30261721E+04
859	4.37903226E+00	4.33050000E+04	4.30385952E+04	2.66404848E+02	4.30344037E+04
860	4.39112903E+00	4.33490000E+04	4.30468281E+04	3.02171857E+02	4.30426583E+04
861	4.40322581E+00	4.29730000E+04	4.30550843E+04	-8.20843415E+01	4.30509360E+04
862	4.41532258E+00	4.32250000E+04	4.30633637E+04	1.61636254E+02	4.30592367E+04
863	4.42741935E+00	4.27510000E+04	4.30716664E+04	-3.20666354E+02	4.30675605E+04
864	4.43951613E+00	4.25090000E+04	4.30799922E+04	-5.70992165E+02	4.30759073E+04
865	4.45161290E+00	4.31580000E+04	4.30883412E+04	6.96588235E+01	4.30842771E+04
866	4.46370968E+00	4.31620000E+04	4.30967134E+04	6.52866126E+01	4.30926700E+04
867	4.47580645E+00	4.31370000E+04	4.31051088E+04	3.18912041E+01	4.31010859E+04
868	4.48790323E+00	4.31300000E+04	4.31135274E+04	1.64725996E+01	4.31095249E+04
869	4.50000000E+00	4.25660000E+04	4.31219692E+04	-1.55969199E+02	4.31179869E+04
870	4.51209677E+00	4.31400000E+04	4.31304342E+04	9.56580891E+00	4.31264719E+04
871	4.52419355E+00	4.29530000E+04	4.31389224E+04	-1.85922374E+02	4.31349800E+04
872	4.53629032E+00	4.28370000E+04	4.31474337E+04	-3.10433747E+02	4.31435111E+04
873	4.54838710E+00	4.32910000E+04	4.31559683E+04	1.35031651E+02	4.31520653E+04
874	4.56048387E+00	4.30650000E+04	4.31645261E+04	-9.95260568E+01	4.31606425E+04
875	4.57258065E+00	4.29360000E+04	4.31731070E+04	-2.37106950E+02	4.31692427E+04
876	4.58467742E+00	4.31610000E+04	4.31817111E+04	-2.07111080E+01	4.31778660E+04
877	4.59677419E+00	4.34290000E+04	4.31903384E+04	2.38661552E+02	4.31865123E+04
878	4.60887097E+00	4.35400000E+04	4.31989889E+04	3.41011111E+02	4.31951817E+04
879	4.62096774E+00	4.30590000E+04	4.32076626E+04	-1.48662551E+02	4.32038741E+04
880	4.63306452E+00	4.30420000E+04	4.32163594E+04	-1.74359390E+02	4.32125896E+04
881	4.64516129E+00	4.31400000E+04	4.32250794E+04	-8.50794066E+01	4.32213280E+04
882	4.65725806E+00	4.33160000E+04	4.32338226E+04	8.21774012E+01	4.32300896E+04
883	4.66935484E+00	4.33180000E+04	4.32425890E+04	7.54110346E+01	4.32388741E+04
884	4.68145161E+00	4.33870000E+04	4.32513785E+04	1.35621495E+02	4.32476817E+04
885	4.69354839E+00	4.26930000E+04	4.32601912E+04	-5.67191217E+02	4.32565124E+04
886	4.70564516E+00	4.33900000E+04	4.32690271E+04	1.20972901E+02	4.32653661E+04
887	4.71774194E+00	4.33250000E+04	4.32778862E+04	4.71138499E+01	4.32742428E+04
888	4.72983871E+00	4.35710000E+04	4.32867684E+04	2.84231631E+02	4.32831426E+04
889	4.74193548E+00	4.32310000E+04	4.32956738E+04	-6.46737557E+01	4.32920654E+04
890	4.75403226E+00	4.29910000E+04	4.33046023E+04	-3.13602307E+02	4.33010112E+04
891	4.76612903E+00	4.33500000E+04	4.33135540E+04	3.64459764E+01	4.33099801E+04
892	4.77822581E+00	4.29840000E+04	4.33225289E+04	-3.38528903E+02	4.33189720E+04
893	4.79032258E+00	4.33730000E+04	4.33315269E+04	4.14730556E+01	4.33279870E+04
894	4.80241935E+00	4.34190000E+04	4.33405481E+04	7.84518532E+01	4.33370250E+04
895	4.81451613E+00	4.31590000E+04	4.33495925E+04	-1.90592509E+02	4.33460861E+04
896	4.82661290E+00	4.32620000E+04	4.33586600E+04	-9.66600296E+01	4.33551702E+04
897	4.83870968E+00	4.37290000E+04	4.33677507E+04	3.61249292E+02	4.33642773E+04
898	4.85080645E+00	4.29180000E+04	4.33768645E+04	-4.58864542E+02	4.33734075E+04
899	4.86290323E+00	4.30900000E+04	4.33860015E+04	-2.96001532E+02	4.33825607E+04
900	4.87500000E+00	4.33710000E+04	4.33951617E+04	-2.41616765E+01	4.33917369E+04
901	4.88709677E+00	4.34520000E+04	4.34043450E+04	4.76550261E+01	4.34009362E+04
902	4.89919355E+00	4.34430000E+04	4.34135514E+04	2.94485766E+01	4.34101586E+04
903	4.91129032E+00	4.38090000E+04	4.34227810E+04	3.86218976E+02	4.34194039E+04
904	4.92338710E+00	4.33280000E+04	4.34320338E+04	-1.04033775E+02	4.34286723E+04
905	4.93548387E+00	4.37540000E+04	4.34413097E+04	3.12690326E+02	4.34379638E+04
906	4.94758065E+00	4.33710000E+04	4.34506087E+04	-7.96087221E+01	4.34472783E+04
907	4.95967742E+00	4.35240000E+04	4.34599309E+04	6.40690831E+01	4.34566158E+04
908	4.97177419E+00	4.30510000E+04	4.34692763E+04	-4.18276258E+02	4.34659764E+04

909	4.98387097E+00	4.33290000E+04	4.34786447E+04	-1.49644744E+02	4.34753600E+04
910	4.99596774E+00	4.33340000E+04	4.34880364E+04	-1.54036374E+02	4.34847667E+04
911	5.00806452E+00	4.34720000E+04	4.34974511E+04	-2.54511472E+01	4.34941964E+04
912	5.02016129E+00	4.35810000E+04	4.35068891E+04	7.41109372E+01	4.35036491E+04
913	5.03225806E+00	4.31440000E+04	4.35163501E+04	-3.72350120E+02	4.35131249E+04
914	5.04435484E+00	4.37540000E+04	4.35258343E+04	2.28165683E+02	4.35226237E+04
915	5.05645161E+00	4.32350000E+04	4.35353417E+04	-2.00341654E+02	4.35321456E+04
916	5.06854839E+00	4.36430000E+04	4.35448721E+04	9.81278706E+01	4.35416905E+04
917	5.08064516E+00	4.36120000E+04	4.35544257E+04	5.75742574E+01	4.35512584E+04
918	5.09274194E+00	4.35700000E+04	4.35640025E+04	5.99750730E+00	4.35608494E+04
919	5.10483871E+00	4.31860000E+04	4.35736024E+04	-3.87602379E+02	4.35704634E+04
920	5.11693548E+00	4.35440000E+04	4.35832254E+04	-3.92254000E+01	4.35801005E+04
921	5.12903226E+00	4.35000000E+04	4.35929716E+04	-9.28715556E+01	4.35897606E+04
922	5.14112903E+00	4.34650000E+04	4.36025408E+04	-1.37540845E+02	4.35994437E+04
923	5.15322581E+00	4.35610000E+04	4.36122333E+04	-5.12332662E+01	4.36091499E+04
924	5.16532258E+00	4.35010000E+04	4.36219488E+04	-1.20948820E+02	4.36188701E+04
925	5.17741935E+00	4.34290000E+04	4.36316875E+04	-2.02687504E+02	4.36286314E+04
926	5.18951613E+00	4.34930000E+04	4.36414493E+04	-1.48449319E+02	4.36384067E+04
927	5.20161290E+00	4.38680000E+04	4.36512343E+04	2.16765737E+02	4.36482050E+04
928	5.21370568E+00	4.40690000E+04	4.36610423E+04	4.07957664E+02	4.36580264E+04
929	5.22580645E+00	4.35880000E+04	4.36708735E+04	3.17126464E+02	4.36678708E+04
930	5.23790323E+00	4.34520000E+04	4.36807279E+04	-2.28727864E+02	4.36777383E+04
931	5.25000000E+00	4.35630000E+04	4.36906053E+04	2.72394682E+02	4.36876288E+04
932	5.26209677E+00	4.37000000E+04	4.37005059E+04	-5.05897611E-01	4.36975423E+04
933	5.27419355E+00	4.33760000E+04	4.37104296E+04	-3.34429602E+02	4.37074789E+04
934	5.28629032E+00	4.38140000E+04	4.37203764E+04	9.36235653E+01	4.37174385E+04
935	5.29838710E+00	4.37960000E+04	4.37303464E+04	6.56536173E+01	4.37274212E+04
936	5.31048387E+00	4.37880000E+04	4.37403395E+04	4.76605426E+01	4.37374269E+04
937	5.32258065E+00	4.37530000E+04	4.37503557E+04	2.64434559E+00	4.37474557E+04
938	5.33467742E+00	4.36180000E+04	4.37603950E+04	-1.42394972E+02	4.37575074E+04
939	5.34677419E+00	4.38180000E+04	4.37704574E+04	4.75425856E+01	4.37675823E+04
940	5.35887097E+00	4.36630000E+04	4.37805430E+04	8.24570312E+01	4.37776801E+04
941	5.37096774E+00	4.40090000E+04	4.37906516E+04	2.18348354E+02	4.37878010E+04
942	5.38306452E+00	4.36750000E+04	4.38007834E+04	-1.25783442E+02	4.37979450E+04
943	5.39516129E+00	4.37150000E+04	4.38109384E+04	-5.59383565E+01	4.38081120E+04
944	5.40725806E+00	4.41030000E+04	4.38211164E+04	2.81883612E+02	4.38183020E+04
945	5.41935484E+00	4.41950000E+04	4.38313175E+04	3.53682465E+02	4.38285151E+04
946	5.43145161E+00	4.39140000E+04	4.38415418E+04	7.24582009E+01	4.38387512E+04
947	5.44354839E+00	4.42270000E+04	4.38517892E+04	3.75210822E+02	4.38490103E+04
948	5.45564516E+00	4.36250000E+04	4.38620597E+04	-2.37059672E+02	4.38592925E+04
949	5.46774194E+00	4.40070000E+04	4.38723533E+04	1.34646721E+02	4.38695977E+04
950	5.47983871E+00	4.38020000E+04	4.38826700E+04	-8.06700004E+01	4.38799260E+04
951	5.49193548E+00	4.35590000E+04	4.38930098E+04	-3.34009834E+02	4.38890277E+04
952	5.50403226E+00	4.40410000E+04	4.39033728E+04	1.37627220E+02	4.39006517E+04
953	5.51612903E+00	4.39770000E+04	4.39137588E+04	6.32411621E+01	4.39110491E+04
954	5.52822581E+00	4.43200000E+04	4.39241680E+04	3.95831953E+02	4.39214695E+04
955	5.54032258E+00	4.40570000E+04	4.39346003E+04	1.22399714E+02	4.39319130E+04
956	5.55241935E+00	4.41870000E+04	4.39450557E+04	2.41944326E+02	4.39423795E+04
957	5.56451613E+00	4.38020000E+04	4.3955342E+04	-1.53534173E+02	4.39528690E+04
958	5.57661290E+00	4.36270000E+04	4.39660358E+04	-3.39035780E+02	4.39633816E+04
959	5.58870968E+00	4.42230000E+04	4.39765605E+04	2.51439505E+02	4.39739173E+04
960	5.60080645E+00	4.40960000E+04	4.39871083E+04	1.08891683E+02	4.39844759E+04
961	5.61290323E+00	4.41110000E+04	4.39976792E+04	1.13320753E+02	4.39950577E+04
962	5.62500000E+00	4.38830000E+04	4.40082733E+04	-1.25273283E+02	4.40056624E+04
963	5.63709677E+00	4.42370000E+04	4.40188904E+04	2.18109575E+02	4.40162902E+04
964	5.64919355E+00	4.40920000E+04	4.40295307E+04	6.24693277E+01	4.40269410E+04
965	5.66129032E+00	4.37720000E+04	4.40401940E+04	-2.68194025E+02	4.40376149E+04
966	5.67338710E+00	4.40380000E+04	4.40508805E+04	-1.28804813E+01	4.40483118E+04
967	5.68548387E+00	4.42900000E+04	4.40615900E+04	2.28409958E+02	4.40590318E+04
968	5.69758065E+00	4.39130000E+04	4.40723227E+04	-1.59322706E+02	4.40697748E+04
969	5.70967742E+00	4.42590000E+04	4.40830785E+04	1.75921528E+02	4.40805408E+04
970	5.72177419E+00	4.41650000E+04	4.40938573E+04	7.11426587E+01	4.40913209E+04
971	5.73387097E+00	4.39910000E+04	4.41046593E+04	-1.13659312E+02	4.41021470E+04
972	5.74596774E+00	4.41310000E+04	4.41154944E+04	6.55156158E+01	4.41129772E+04

973	5.75806452E+00	4.42690000E+04	4.41263326E+04	1.42667443E+02	4.41238354E+04
974	5.77016129E+00	4.41950000E+04	4.41372038E+04	5.77961694E+01	4.41347166E+04
975	5.78225806E+00	4.44190000E+04	4.41480982E+04	2.70901756E+02	4.41456209E+04
976	5.79435484E+00	4.45170000E+04	4.41590157E+04	3.57984324E+02	4.41565482E+04
977	5.80645161E+00	4.41950000E+04	4.41699562E+04	2.50437520E+01	4.41674986E+04
978	5.81854839E+00	4.40300000E+04	4.41809199E+04	-1.00919918E+02	4.41784720E+04
979	5.83064516E+00	4.43560000E+04	4.41919067E+04	1.64093314E+02	4.41894684E+04
980	5.84274194E+00	4.42270000E+04	4.42029166E+04	2.40834483E+01	4.42004879E+04
981	5.85483871E+00	4.35370000E+04	4.42139495E+04	-2.76949514E+02	4.42115304E+04
982	5.86693548E+00	4.42620000E+04	4.42250056E+04	3.69944262E+01	4.42225960E+04
983	5.87903226E+00	4.40630000E+04	4.42360847E+04	-1.73084729E+02	4.42336846E+04
984	5.89112503E+00	4.39110000E+04	4.42471870E+04	-3.36186981E+02	4.42447962E+04
985	5.90322581E+00	4.42440000E+04	4.42583123E+04	-1.43123276E+01	4.42559309E+04
986	5.91532258E+00	4.43430000E+04	4.42694608E+04	7.35392308E+01	4.42670886E+04
987	5.92741935E+00	4.44110000E+04	4.42806323E+04	1.30367695E+02	4.42782604E+04
988	5.93951613E+00	4.43590000E+04	4.42918269E+04	6.71730643E+01	4.42894732E+04
989	5.95161290E+00	4.46010000E+04	4.43030447E+04	2.97955340E+02	4.43007000E+04
990	5.96370968E+00	4.42230000E+04	4.43142855E+04	-9.12854768E+01	4.43119409E+04
991	5.97580645E+00	4.43380000E+04	4.43255494E+04	1.24506132E+01	4.43232229E+04
992	5.98790323E+00	4.43650000E+04	4.43368364E+04	2.81636107E+01	4.43345188E+04
993	6.00000000E+00	4.44620000E+04	4.43481465E+04	1.13453516E+02	4.43459378E+04

STD= 2.103220E+02

CASE NO. 1 IERR= 2

COEFFICIENTS OF PARABOLA Y= SA*X**2 + B*X + C

SA= 7.89164728E+01(*6.832E-C1) B=-8.07869030E+00(*1.931E+00) C= 4.17639214E+04(*1.190E+01)

NO. OF ITERATIONS= 2

PARAMETERS FOR PEAK 1

IS=-2.82731400E-01 GAM= 2.50420241E-01

A= 4.33457466E+03(*6.869E+C1) P=-2.82731400E-01(*2.301E-03) CGAM= 1.45210120E-01(*3.545E-03) AREA= 1.94686613E+03

PHI1= 1.03766191E-01 PHI2= 3.79853320E-03 PHI1/PHI2= 2.73174370E+01

CASE NO. 1 IERR= 3

COEFFICIENTS OF PARABOLA Y= SA*X**2 + B*X + C

SA= 7.85361965E+01(*6.759E-C1) B=-8.03974281E+00(*1.922E+00) C= 4.13561687E+04(*1.184E+01)

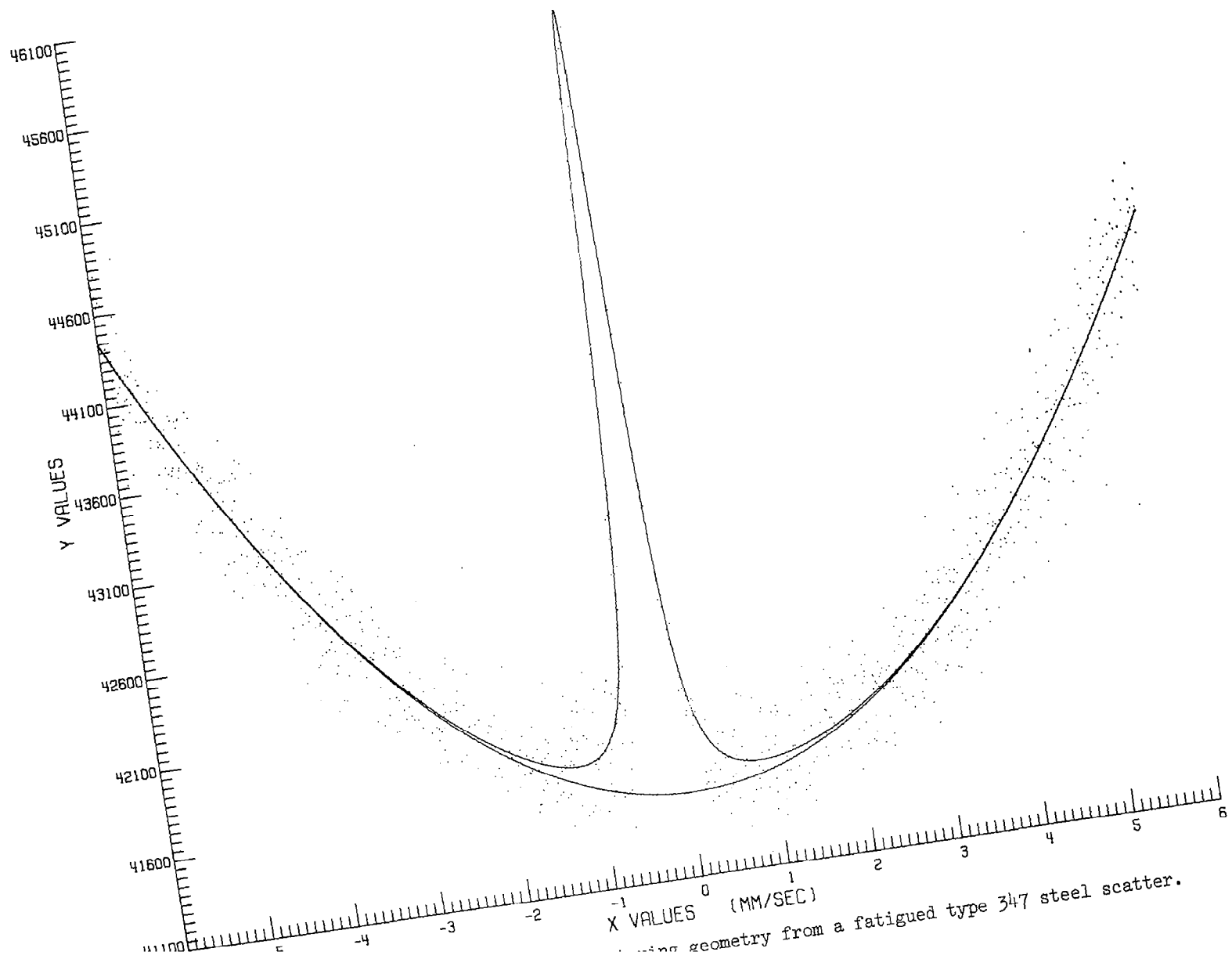
NO. OF ITERATIONS= 3

PARAMETERS FOR PEAK 1

IS=-2.82731494E-01 GAM= 2.90411489E-01

A= 4.31387967E+03(*6.836E+C1) P=-2.82731494E-01(*2.300E-03) CGAM= 1.45205744E-01(*3.544E-03) AREA= 1.93751354E+03

PHI1= 1.04288865E-01 PHI2= 3.81713460E-03 PHI1/PHI2= 2.73212437E+01



APPENDIX C - Continued

...ing geometry from a fatigued type 347 steel scatter.

Sample Case 2

Input. -

```

$NAME IFLAG=1, IERR=1, IPRINT=0,
NP=1, ERROR=6*1.E-6,
AO=-1000, PO=-.2, CGAM0=.2,
SAO=10, BO=3, VELB=6, $
      2
      1000
  2 24219  3 24215  4 24207  5 24305  6 24109  7 24438  8 24205  9 24336
10 24402 11 24216 12 23899 13 24326 14 24497 15 24217 16 24381 17 24335
18 24392 19 24400 20 24320 21 24261 22 24631 23 24394 24 24391 25 24374
26 24341 27 24346 28 24172 29 24233 30 24062 31 24238 32 24415 33 24404
34 24380 35 24476 36 24436 37 24205 38 24413 39 24533 40 24300 41 24343
42 24443 43 24112 44 24507 45 24421 46 24316 47 24233 48 24616 49 24515
50 24091 51 24298 52 24324 53 24162 54 24115 55 24222 56 24515 57 24740
58 24441 59 24598 60 24597 61 24360 62 24437 63 24561 64 24344 65 24648
66 24379 67 24312 68 24099 69 24354 70 24360 71 24378 72 24570 73 24132
74 24544 75 24226 76 24508 77 24107 78 24509 79 24093 80 24592 81 24802
82 24319 83 24534 84 24327 85 24679 86 24143 87 24580 88 24536 89 24495
90 24454 91 24413 92 24385 93 24338 94 24574 95 24584 96 24595 97 24766
98 24354 99 24507 100 24519 101 24531 102 24525 103 24619 104 24502 105 24521
106 24288 107 24592 108 24305 109 24560 110 24443 111 24504 112 24533 113 24390
114 24445 115 24619 116 24559 117 24335 118 24570 119 24556 120 24183 121 24323
122 24529 123 24440 124 24490 125 24402 126 24539 127 24726 128 24445 129 24288
130 24706 131 24578 132 24158 133 24488 134 24282 135 24201 136 24756 137 24288
138 24321 139 24599 140 24403 141 24688 142 24610 143 24927 144 24495 145 24653
146 24615 147 24651 148 24759 149 24444 150 24469 151 24608 152 24456 153 24448
154 24588 155 24508 156 24742 157 24600 158 24370 159 24309 160 24516 161 24908
162 24694 163 24548 164 24512 165 24597 166 24803 167 24584 168 24455 169 24497
170 24820 171 24368 172 24809 173 24668 174 24652 175 24267 176 24488 177 24789
178 24595 179 24935 180 24564 181 24676 182 24761 183 24543 184 24617 185 24455
186 24494 187 24802 188 24535 189 24895 190 24433 191 24620 192 24378 193 24646
194 24719 195 24597 196 24666 197 24563 198 24664 199 24834 200 24635 201 24549
202 24407 203 24324 204 24736 205 24532 206 24465 207 25038 208 24590 209 24589
210 24819 211 24708 212 24778 213 24678 214 24612 215 24761 216 24585 217 24702
218 24754 219 24897 220 24667 221 24759 222 24911 223 24724 224 24528 225 24500
226 24729 227 24702 228 24885 229 24466 230 24639 231 24793 232 24333 233 24620
234 25016 235 24455 236 24936 237 24682 238 24693 239 24737 240 24465 241 24753
242 24603 243 24439 244 24758 245 24749 246 24782 247 24983 248 24803 249 24361
250 24830 251 24753 252 24913 253 24844 254 24849 255 24697 256 24691 257 24930
258 24767 259 24790 260 24853 261 24628 262 24718 263 24761 264 24909 265 24676
266 24869 267 24810 268 24489 269 24694 270 24743 271 24721 272 24669 273 24627
274 24599 275 24939 276 24822 277 24986 278 24866 279 24997 280 24816 281 24928
282 24547 283 24830 284 24862 285 24839 286 24700 287 24766 288 24677 289 24931
290 24448 291 25057 292 24585 293 24978 294 24854 295 24648 296 24910 297 24550
298 24911 299 24920 300 24626 301 24814 302 24789 303 24678 304 24873 305 24747
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314 24690 315 24914 316 24878 317 24995 318 25089 319 24669 320 24776 321 24868
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354 24569 355 25241 356 24691 357 24823 358 25020 359 24944 360 24692 361 24854
362 24897 363 24704 364 24663 365 24920 366 25146 367 24724 368 24605 369 24969
370 24873 371 24923 372 24774 373 24845 374 24915 375 24826 376 24954 377 24981
378 25145 379 25144 380 24997 381 25134 382 24921 383 25018 384 24726 385 25113
386 24610 387 24625 388 24971 389 25060 390 25003 391 24918 392 24537 393 24827
394 25005 395 24916 396 24513 397 24905 398 25162 399 24782 400 24863 401 24873
402 24828 403 25026 404 24959 405 24888 406 25009 407 25031 408 25029 409 24954
410 25142 411 25017 412 24923 413 25055 414 25031 415 24864 416 24925 417 24837

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418	25086	419	24955	420	24664	421	24989	422	25122	423	24948	424	25123	425	24996
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434	24715	435	24809	436	25072	437	24524	438	24893	439	25342	440	24754	441	24884
442	24737	443	24708	444	24632	445	24819	446	24990	447	24996	448	24535	449	25241
450	25084	451	24857	452	24667	453	24886	454	24760	455	24817	456	24937	457	24856
458	24774	459	24983	460	24831	461	24819	462	25225	463	24664	464	24574	465	24864
466	24829	467	25104	468	24829	469	24674	470	25044	471	24880	472	24821	473	24717
474	24742	475	24736	476	24572	477	24673	478	24521	479	24833	480	24733	481	24645
482	24838	483	24777	484	24773	485	24671	486	24822	487	24847	488	24946	489	25078
490	24725	491	24956	492	24839	493	24737	494	24583	495	25121	496	24634	497	24351
498	24771	499	24893	500	24857	501	24888	502	24904	503	24676	504	24679	505	24675
506	24770	507	24667	508	24686	509	24575	510	24747	511	24487	512	24383	513	24248
514	24619	515	24365	516	24321	517	24397	518	23982	519	24186	520	24160	521	23879
522	24016	523	23697	524	23742	525	23790	526	23796	527	23283	528	23520	529	23394
530	23208	531	23345	532	22978	533	23149	534	23076	535	23231	536	23070	537	22863
538	22788	539	23047	540	23150	541	23144	542	23118	543	23098	544	23420	545	23598
546	23450	547	23665	548	23741	549	23625	550	23723	551	24196	552	23901	553	24197
554	24368	555	24294	556	24533	557	24131	558	24572	559	24400	560	24512	561	24826
562	24581	563	24521	564	24658	565	24428	566	24646	567	24601	568	24410	569	24481
570	24771	571	24816	572	24740	573	25060	574	24530	575	25047	576	24919	577	24412
578	24716	579	24690	580	24813	581	24955	582	24736	583	24866	584	24497	585	24900
586	24732	587	24875	588	24838	589	24949	590	24583	591	24837	592	24754	593	24473
594	24611	595	25025	596	24794	597	24856	598	24884	599	24690	600	24509	601	24758
602	24939	603	24729	604	24752	605	24781	606	24900	607	25007	608	24756	609	24816
610	24445	611	24738	612	24784	613	24892	614	24768	615	24799	616	24920	617	24503
618	25068	619	24795	620	24672	621	24974	622	25008	623	24886	624	24724	625	24856
626	24620	627	25036	628	24779	629	24634	630	24970	631	24902	632	24827	633	24733
634	24950	635	24724	636	24715	637	25124	638	24768	639	25019	640	25189	641	24449
642	24507	643	24802	644	24713	645	24737	646	24728	647	24921	648	24359	649	24561
650	24752	651	24824	652	25119	653	24863	654	24779	655	24950	656	24615	657	24395
658	25192	659	24842	660	25196	661	24449	662	24680	663	24720	664	25206	665	24912
666	24807	667	24893	668	24794	669	24959	670	24837	671	24823	672	24817	673	24519
674	24695	675	24886	676	24881	677	24672	678	24902	679	24836	680	24912	681	24853
682	24837	683	24742	684	24744	685	24476	686	24801	687	24643	688	24782	689	25014
690	24530	691	24922	692	24633	693	24840	694	24892	695	24907	696	24602	697	24901
698	24976	699	24748	700	24867	701	24583	702	24830	703	24823	704	24384	705	24960
706	24965	707	24769	708	24992	709	24804	710	24798	711	24676	712	24418	713	24978
714	24760	715	24712	716	24905	717	24725	718	24851	719	24662	720	24733	721	25023
722	24752	723	24700	724	24674	725	24770	726	24659	727	24792	728	24901	729	24692
730	24641	731	24766	732	24855	733	24754	734	24945	735	24748	736	24939	737	24685
738	24573	739	25020	740	24720	741	24620	742	24685	743	24750	744	24555	745	24697
746	24722	747	24743	748	24496	749	24651	750	24499	751	24831	752	24841	753	24847
754	24671	755	24775	756	24683	757	24766	758	24731	759	24565	760	24682	761	24732
762	24362	763	24774	764	24746	765	24575	766	24352	767	24595	768	24820	769	24754
770	24947	771	24764	772	24847	773	24696	774	24636	775	24878	776	24491	777	24946
778	24849	779	24912	780	24397	781	24859	782	24655	783	24866	784	24711	785	24653
786	24632	787	24843	788	24648	789	24662	790	24606	791	24778	792	24704	793	24779
794	24651	795	24841	796	24754	797	24630	798	24803	799	24498	800	24650	801	24655
802	24558	803	24724	804	24549	805	24666	806	24566	807	24638	808	24587	809	24674
810	24728	811	24629	812	24792	813	24525	814	24743	815	24728	816	24510	817	24692
818	24627	819	24656	820	24673	821	24770	822	24714	823	24765	824	24290	825	24413
826	24700	827	24837	828	24665	829	24323	830	24664	831	24773	832	24672	833	24575
834	24550	835	24639	836	24569	837	24416	838	24651	839	24325	840	24482	841	24712
842	24623	843	24565	844	24608	845	24952	846	24668	847	24306	848	24665	849	24604
850	24534	851	24567	852	24488	853	24455	854	24831	855	24523	856	24476	857	24567
858	24651	859	24425	860	24676	861	24443	862	24723	863	24546	864	24507	865	24769
866	24535	867	24559	868	24846	869	24680	870	24917	871	24294	872	24612	873	24452
874	24496	875	24154	876	24419	877	24521	878	24716	879	24502	880	24689	881	24701
882	24702	883	24479	884	24684	885	24710	886	24604	887	24604	888	24419	889	24515
890	24717	891	24524	892	24443	893	24771	894	24340	895	24614	896	24535	897	24593
898	24888	899	24609	900	24717	901	24346	902	24520	903	24293	904	24575	905	24656
906	24506	907	24488	908	24593	909	24482	910	24235	911	24476	912	24617	913	24511
914	24714	915	24144	916	24353	917	24711	918	24323	919	24620	920	24561	921	24511
922	24282	923	24510	924	24395	925	24386	926	24427	927	24633	928	24338	929	24200

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930 24647 931 24295 932 24361 933 24477 934 24312 935 24611 936 24363 937 24392
938 24374 939 24326 940 24563 941 24472 942 24258 943 24388 944 24594 945 24402
946 24129 947 24324 948 24376 949 24387 950 24237 951 24515 952 24291 953 24304
954 24307 955 24295 956 24342 957 24242 958 24589 959 24463 960 24557 961 24297
962 24476 963 24233 964 24362 965 24183 966 24042 967 24251 968 24212 969 24253
970 24196 971 24203 972 24379 973 24508 974 24485 975 24175 976 24294 977 24442
978 24403 979 24483 980 24317 981 24505 982 24035 983 24129 984 24182 985 24397
986 23918 987 24092 988 24460 989 24419 990 23915 991 24523 992 24339 993 24092
994 24316 995 24277 996 24299 997 24183 998 24253 999 243451000 240971001 24199

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Output.- The computed values given below do not include the velocity calibration correction factor of 1.274.
Figure 7 is included as a sample computer plot.

```

CASE NO.      2      IERR=  1
COEFFICIENTS OF PARABOLA  Y= SA*X**2 + B*X + C
SA=-1.87751204E+01(*5.103E-01)      B=-5.68151598E-01(*1.434E+00)      C= 2.49184310E+04(*8.948E+00)
NC. OF ITERATIONS= 12
PARAMETERS FOR PEAK  1
IS=-4.19525441E-01      GAM=-3.15759782E-01
A=-1.99927587E+03(*4.890E+01)      P=-4.19525441E-01(*3.860E-03)      CGAM=-1.57899891E-01(*5.989E-03)      AREA=-9.75063770E+02
PHI1=-8.02426495E-02      PHI2= 3.29060414E-03      PHI1/PHI2=-2.43854460E+01

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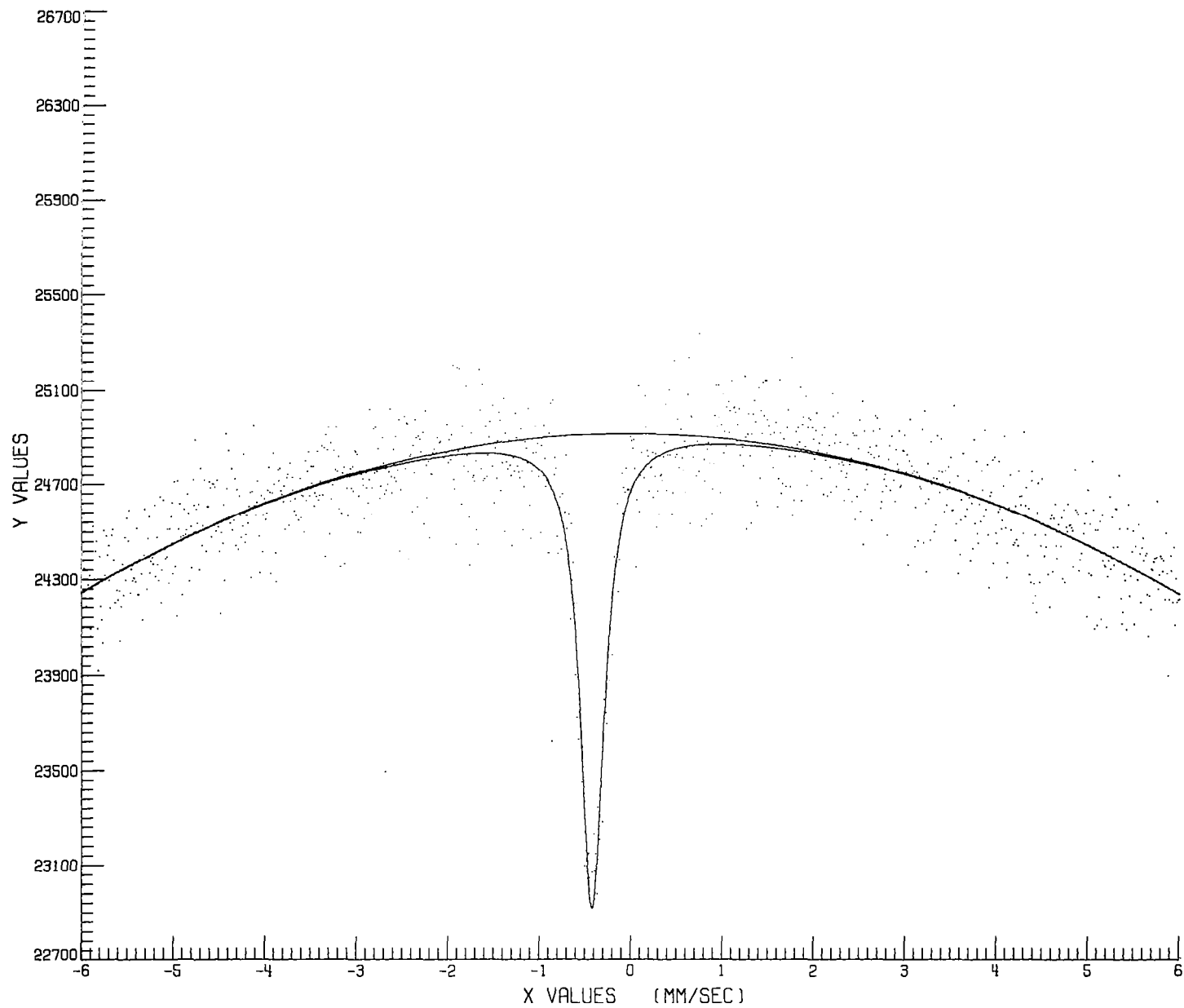


Figure 7.- Transmission Mössbauer spectrum through a 25- μ m-thick type 316 steel absorber.

Sample Case 3

Input.

```

$NAME IFLAG=1, IPRR=1, IPRINT=0,
NP=6, CCAMN=6*.2, FPRNC=21*1.F-5,
PQ=-5.5,-3.25,-1.1,.5,2.7,4.8,
AQ=-1700,-1450,-900,-900,-1450,-2000,
SAN=67., RQ=-2.4, VELR=6., *

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      3 -1015
  2 87291  3 87741  4 97402  5 87727  6 88032  7 87528  8 87798  9 87380
10 97831 11 87551 12 87599 13 87168 14 87199 15 97037 16 97305 17 87078
18 87703 19 87561 20 87510 21 37692 22 87418 23 87156 24 86592 25 86965
26 86851 27 97223 28 86726 29 86613 30 86376 31 87009 32 86347 33 86484
34 36622 35 86785 36 87597 37 85760 38 85563 39 85815 40 85600 41 86430
42 86231 43 86104 44 85934 45 85439 46 85877 47 85565 48 85445 49 86312
50 85819 51 85809 52 86266 53 86089 54 86601 55 86297 56 86290 57 86228
58 85935 59 86167 60 86155 61 87034 62 86917 63 97072 64 86555 65 86720
66 86899 67 86325 68 87041 69 86875 70 86917 71 86824 72 86491 73 86743
74 87281 75 87360 76 86497 77 87166 78 97133 79 86829 80 86711 81 86881
82 86732 83 86962 84 86743 85 86728 86 87190 87 87046 88 86876 89 86959
90 86807 91 86811 92 87022 93 87117 94 86747 95 86523 96 86661 97 86543
98 86739 99 86950 100 97272 101 87169 102 87074 103 87510 104 86468 105 86723
106 86662 107 87218 108 86894 109 87053 110 87091 111 86647 112 87051 113 86654
114 86937 115 86782 116 87155 117 87030 118 86612 119 87220 120 86905 121 86690
122 87042 123 86806 124 87225 125 86690 126 87277 127 86643 128 87187 129 87491
130 86937 131 87349 132 86900 133 86762 134 86597 135 86843 136 86581 137 87143
138 86884 139 86593 140 86477 141 87409 142 86897 143 85971 144 86327 145 86910
146 86980 147 86151 148 86700 149 86993 150 86801 151 86678 152 86354 153 86639
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178 86638 179 86854 180 86256 181 86130 182 86555 183 86132 184 86386 185 86294
186 86526 187 86238 188 87001 189 86052 190 86449 191 86922 192 86303 193 86430
194 86226 195 86214 196 86405 197 86706 198 86833 199 86317 200 86839 201 86579
202 86001 203 85164 204 86693 205 86020 206 86320 207 86038 208 86262 209 85803
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218 85932 219 85968 220 85018 221 85115 222 85112 223 85264 224 85487 225 85176
226 85393 227 84604 228 84575 229 84785 230 84762 231 84538 232 84984 233 84264
234 84927 235 84719 236 84719 237 85302 238 85112 239 83957 240 84936 241 85409
242 85196 243 85205 244 85710 245 85378 246 85509 247 85650 248 85256 249 84778
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258 85622 259 85520 260 85363 261 85617 262 85546 263 85781 264 85636 265 85962
266 86007 267 85398 268 85306 269 86247 270 86249 271 85756 272 85922 273 85743
274 85717 275 85919 276 85219 277 85374 278 86038 279 86235 280 86231 281 85879
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314 85786 315 85564 316 85876 317 85750 318 85716 319 86465 320 86039 321 86354
322 86040 323 86060 324 86014 325 86004 326 85943 327 85949 328 86133 329 85510
330 86026 331 85624 332 85886 333 86233 334 85137 335 85605 336 85291 337 85677
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386 85910 387 85723 388 85662 389 85522 390 85832 391 85633 392 85375 393 85577
394 86120 395 85802 396 85913 397 85547 398 85538 399 85542 400 85469 401 85540
402 85380 403 85809 404 85334 405 85296 406 85440 407 85277 408 85465 409 85129
410 85445 411 84715 412 84917 413 84998 414 85221 415 84902 416 84897 417 84676

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418	85275	410	84551	420	84955	421	84957	422	84516	423	84823	424	84863	425	84796
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434	85225	435	85225	436	85430	437	84952	438	85754	439	85402	440	85241	441	85215
442	85735	443	85687	444	85513	445	85632	446	85721	447	85063	448	85517	449	85476
450	85986	451	85514	452	85883	453	85921	454	86078	455	85155	456	85239	457	85553
458	85451	459	85465	460	85776	461	85734	462	85928	463	85889	464	85449	465	85527
466	85723	467	85415	468	85532	469	85323	470	85305	471	85958	472	85469	473	85212
474	84382	475	85611	476	85464	477	85541	478	85723	479	85348	480	85515	481	84939
482	85926	483	85706	484	85413	485	85151	486	85430	487	85492	488	85592	489	85660
490	85905	491	85659	492	85740	493	85627	494	85513	495	85453	496	85552	497	85934
498	85792	499	85525	500	85735	501	85404	502	85491	503	85102	504	85411	505	85272
506	85809	507	85805	508	85634	509	85938	510	84972	511	85526	512	85437	513	85439
514	85669	515	85779	516	85110	517	84937	518	85333	519	85497	520	85578	521	84934
522	85354	523	85864	524	85343	525	85615	526	85476	527	85949	528	85671	529	85374
530	85022	531	85250	532	85336	533	85086	534	85482	535	85162	536	85695	537	85832
538	85580	539	85311	540	85375	541	85333	542	85206	543	84358	544	84318	545	84910
546	85171	547	84573	548	85011	549	84497	550	84401	551	84794	552	84745	553	84392
554	84558	555	84242	556	84466	557	84715	558	84267	559	85306	560	84434	561	84819
562	85149	563	84969	564	85213	565	85868	566	85408	567	84700	568	85037	569	85386
570	85476	571	84345	572	85676	573	84925	574	85179	575	85249	576	85457	577	85782
578	85473	579	85250	580	85608	581	85113	582	85870	583	85269	584	85423	585	85688
585	85698	586	85341	587	85483	588	85885	589	85824	590	85661	591	85335	592	85331
594	85633	595	85735	596	85336	597	85425	598	85725	599	86462	600	85743	601	85078
602	85954	603	85251	604	86193	605	86013	606	86165	607	85420	608	85931	609	85889
610	85416	611	85647	612	86132	613	85844	614	85754	615	85814	616	85387	617	85437
618	85436	619	85586	620	85812	621	85406	622	85520	623	85496	624	85791	625	85321
626	85471	627	85131	628	85803	629	85547	630	85834	631	85683	632	85705	633	85637
634	86022	635	85662	636	86237	637	86150	638	85820	639	85256	640	85603	641	85649
642	85533	643	85042	644	85557	645	86069	646	85347	647	85121	648	85486	649	85640
650	85195	651	85540	652	85499	653	85339	654	85613	655	85613	656	85936	657	85276
658	85754	659	85203	660	85559	661	85544	662	85828	663	85788	664	85375	665	85752
666	86002	667	85319	668	85591	669	85900	670	85900	671	86165	672	85751	673	85501
674	85723	675	85534	676	85862	677	85165	678	85493	679	85355	680	85611	681	85552
682	85969	683	85800	684	85979	685	86510	686	86263	687	85437	688	86210	689	86053
690	85980	691	85545	692	86125	693	86103	694	85946	695	85653	696	86076	697	85729
698	85200	699	85458	700	85255	701	86262	702	85639	703	85935	704	85905	705	85130
706	85089	707	85636	708	84921	709	85657	710	85845	711	85460	712	85242	713	84906
714	85459	715	86159	716	85205	717	86020	718	85237	719	85485	720	85050	721	85308
722	85395	723	85317	724	84782	725	84736	726	84615	727	85118	728	84937	729	84502
730	84809	731	84378	732	84414	733	84310	734	84867	735	84241	736	84219	737	84769
738	84749	739	84671	740	84291	741	84564	742	84823	743	84755	744	84534	745	85156
746	84914	747	84670	748	84543	749	84365	750	85556	751	85514	752	85453	753	85216
754	85383	755	85484	756	85612	757	85774	758	85351	759	85387	760	85433	761	85864
762	85988	763	85571	764	85549	765	85841	766	86043	767	85612	768	85673	769	86049
770	86116	771	85795	772	85855	773	85281	774	86854	775	85965	776	85485	777	86771
778	85942	779	85976	780	85914	781	84776	782	86079	783	85939	784	86143	785	85983
786	86513	787	85904	788	85590	789	85900	790	86413	791	86175	792	86113	793	86300
794	86414	795	85828	796	86418	797	86744	798	86294	799	86157	800	86435	801	86231
802	86493	803	85202	804	86547	805	86033	806	86339	807	86226	808	86031	809	86426
810	86935	811	86494	812	86574	813	86360	814	86542	815	87010	816	86656	817	86421
818	86129	819	86615	820	86451	821	86317	822	86152	823	86473	824	86132	825	86429
826	85227	827	87017	828	86949	829	86642	830	86586	831	86900	832	86838	833	86253
834	86581	835	86458	836	86220	837	87143	838	86380	839	86771	840	86773	841	86349
842	86215	843	86644	844	86735	845	86853	846	86422	847	86493	848	86373	849	86677
850	86518	851	86610	852	86801	853	86661	854	86937	855	86857	856	86842	857	86755
858	86791	859	86380	860	86453	861	86555	862	86438	863	86472	864	86999	865	86524
866	86170	867	86723	868	86737	869	86563	870	86311	871	86711	872	86696	873	86426
874	87007	875	86765	876	86555	877	86719	878	86747	879	86221	880	87045	881	86555
882	86014	883	86141	884	86148	885	86255	886	86659	887	86341	888	86120	889	86499
890	86717	891	86257	892	85956	893	86282	894	86470	895	86066	896	86059	897	85551
898	85944	899	86060	900	86094	901	85372	902	86141	903	86550	904	86027	905	85259
906	85524	907	85872	908	85311	909	85564	910	84877	911	85106	912	85379	913	85355
914	85210	915	85722	916	84529	917	84968	918	85295	919	85375	920	85243	921	85433
922	85202	923	85637	924	85693	925	85820	926	85749	927	85357	928	86232	929	86637

```

930 86218 931 36524 932 86393 933 36553 934 86420 935 86676 936 86774 937 86650
938 86671 939 86745 940 87155 941 86861 942 86809 943 86806 944 87074 945 87609
946 87269 947 86574 948 86677 949 37374 950 86799 951 87141 952 37131 953 87128
954 87332 955 87825 956 87355 957 37174 958 87253 959 87517 960 86872 961 87705
962 87216 963 87152 964 87537 965 87697 966 87309 967 87692 968 87055 969 87222
970 87760 971 87136 972 87412 973 87946 974 87890 975 87256 976 87405 977 87862
978 87541 979 87180 980 87350 981 88123 982 87588 983 87213 984 87345 985 87623
986 87595 987 88006 988 87953 989 88115 990 87584 991 87421 992 87740 993 87501
994 88221 995 83041 996 87742 997 88173 998 87612 999 878081000 881951001 87801
1002 880501003 877621004 876931005 872441006 877481007 877771008 877131009 88156
1010 878681011 875381012 878631013 879781014 881451015 878191016 87857

```

Output. - The computed values given below do not include the velocity calibration correction factor of 1.274.
Figure 8 is included as a sample computer plot.

```

CASE NC.      3      IERR= 1
COEFFICIENTS OF PARABOLA  Y= SA*X**2 + B*X + C
SA= 6.7086850E+01(71.491E+00)      B= 2.39187959E+00(75.251E+00)      C= 8.56128891E+04(72.223E+01)
NC. OF ITERATIONS= 11
PARAMETERS FOR PEAK 1
IS=-5.45052583E+00      GAM= 4.16110817E-01
A=-1.75334715E+03(76.448E+01)      P=-5.49052583E+00(79.348E-03)      CGAM= 2.08055408E-01(71.914E-02)      AREA=-9.97995019E+02
PARAMETERS FOR PEAK 2
IS=-3.24347788E+00      GAM= 3.04767054E-01
A=-1.65571508E+03(79.160E+01)      P=-3.26347788E+00(78.427E-03)      CGAM= 1.52383547E-01(71.377E-02)      AREA=-7.74450772E+02
PARAMETERS FOR PEAK 3
IS=-1.06681911E+00      GAM= 2.00218439E-01
A=-8.55074490E+02(71.128E+02)      P=-1.06681911E+00(71.262E-02)      CGAM= 1.00159220E-01(71.940E-02)      AREA=-2.78553196E+02
PARAMETERS FOR PEAK 4
IS= 5.19028397E-01      GAM= 2.15334893E-01
A=-1.06891543E+03(71.088E+02)      P= 5.19028397E-01(71.095E-02)      CGAM= 1.07667446E-01(71.711E-02)      AREA=-3.57397985E+02
PARAMETERS FOR PEAK 5
IS= 2.68705065E+00      GAM= 3.47284113E-01
A=-1.68360837E+03(78.587E+01)      P= 2.68705065E+00(78.841E-03)      CGAM= 1.73642057E-01(71.430E-02)      AREA=-8.97278080E+02
PARAMETERS FOR PEAK 6
IS= 4.80368961E+00      GAM= 3.59413650E-01
A=-2.00075135E+03(78.482E+01)      P= 4.80368961E+00(77.592E-03)      CGAM= 1.79706825E-01(71.335E-02)      AREA=-1.06996566E+03
THESE PARAMETERS HAVE BEEN OBTAINED FOR MULTIPLE PEAKS
IS= -3.1581686E-01      CS= 2.7603247E-02      GC1= 3.7528658E+00      GC2= 3.7825063E+00      G1= 2.1966588E+00
M1= 1.1242091E+00      M2= 1.2370192E+00      PFI= 4.2194604E-03

```

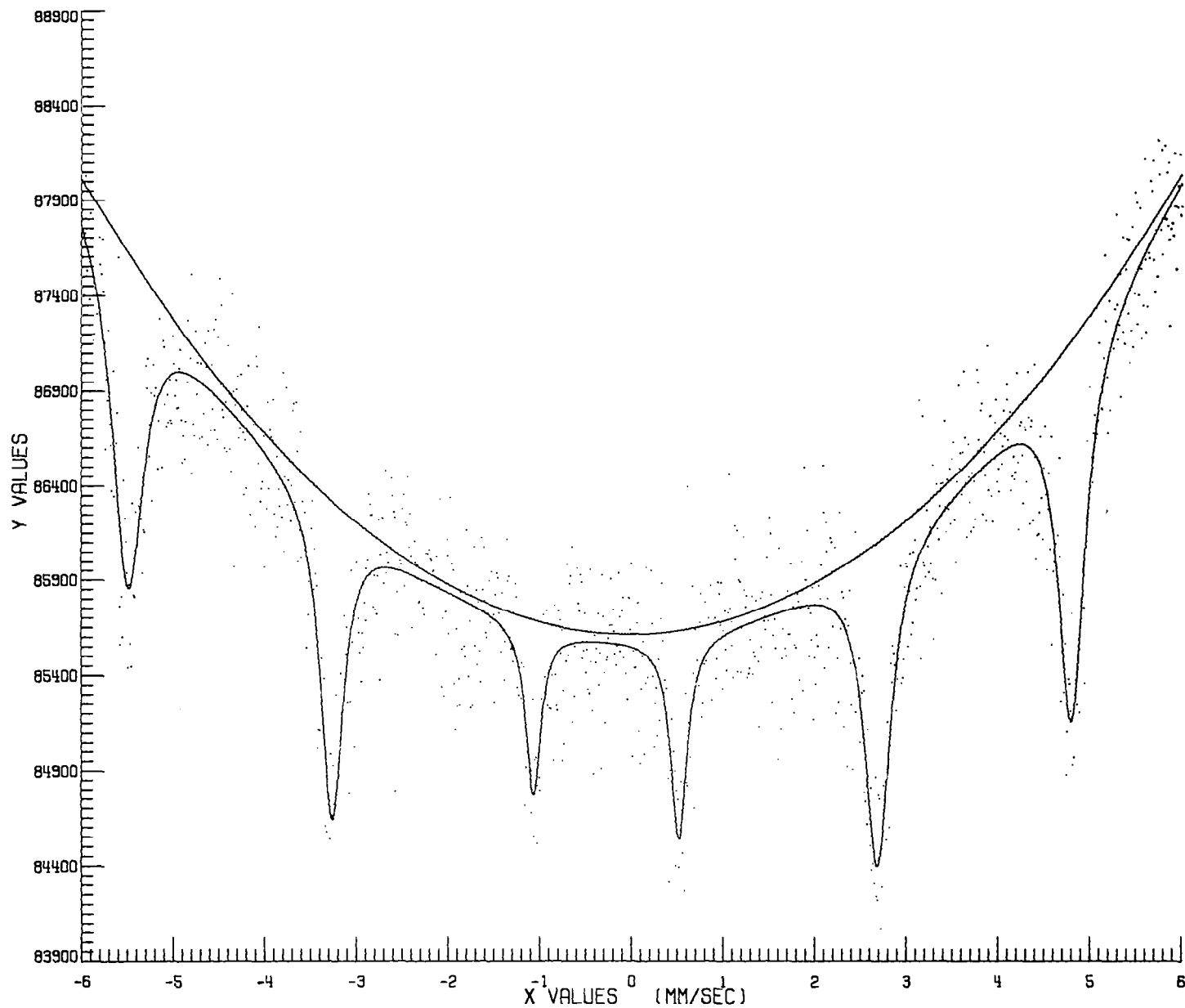


Figure 8.- Transmission Mössbauer spectrum through a 25- μ m-thick AISI C1095 steel absorber.

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